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Addendum No. 3

4410-10-B_4

Report of VESIAC

A BIBLIOGRAPHY OF SEISMOLOGY FOR THE VELA UNIFORM PROGRAM

Addendum No. 3

April 1963

Acoustics and Seismics Laboratory
Institute of Science and Technology
THE UNIVERSITY OF MICHIGAN
Ann Arbor, Michigan

NOTICES

Sponsorship. The work reported herein was conducted by the Institute of Science and Technology for the Advanced Research Projects Agency of the Office of the Secretary of Defense under Contract SD-78. Contracts and grants to The University of Michigan for the support of sponsored research by the Institute of Science and Technology are administered through the Office of the Vice-President for Research.

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In November 1961 VESIAC published A Bibliography of Seismology for the VELA UNIFORM Program, Report No. 4410-10-B, which was followed in April 1962 by Addendum No. 1 and in October 1962 by Addendum No. 2. This third addendum contains abstracts for several hundred additional publications on seismology and the detection of underground explosions, and is printed on punched paper for insertion in the loose-leaf notebook supplied with the Addendum No. 1.

The addendum, like the Bibliography, has two main parts, a subject-author-title list and abstracts of the publications cited; both parts are arranged alphabetically by author. Each author of a publication with multiple authors is listed separately, but the complete reference and abstract are given only under the first-named author. Publications with no author credit are listed under the names of their corporate authors.

Unless otherwise noted, all abstracts from Isvestiya Akademii Nauk are referenced as Bulletin of the Academy of Science USSR, the English translation published by the Ame- in Geophysical Union.

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1. To select areas of interest, consult the Subject Outline, Section 1.
2. Next refer to Section 2, where the Subject Outline is repeated, with the author and title of each abstracted article, book, or report listed alphabetically under the appropriate subject heading.
3. Then turn to Section 3, where the abstracts are arranged alphabetically by author.
4. Refer to the Appendix for a list of reports and articles sponsored by the VELA UNIFORM Program.

1
SUBJECT OUTLINE — VELA UNIFORM PROGRAM

I. Research in Seismology

1. Seismic Source Mechanisms
   a. Earthquakes
   b. Explosions[1]
   c. Seismic Noise
   d. Other Artificial Devices (Oscillators, Weight Drops, Etc.)

2. Seismic Wave Propagation
   a. Theoretical
   b. Observational
   c. Models

3. Seismic Propagation Paths
   a. U. S. Crustal Structure
   b. Foreign Crustal Structure
   c. Mantle and Core
   d. Geophysical Constants (Seismic Velocity, Rock Density, Etc.)

4. Seismic Signal Detection
   a. Surface
   b. Array
   c. Deepwell
   d. Underwater
   e. Special Purpose

5. Seismic Data
   a. Processing
   b. Analysis

6. General Studies[2]

II. Research in Electromagnetic Signals from Underground Disturbances

1. Source Mechanisms

2. Model Studies

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[1]A great number of entries in this bibliography report on seismic phenomena resulting from an explosion. However, to list the reports of every study which uses an explosion energy source under Section I.1.b, "Explosions," would prove unwieldy and less informative than the more discriminative listing chosen. In this grouping, only those articles which are specifically source studies, e.g., energy transfer (coupling and decoupling), cavity formation, plastic zone studies, explosion thermodynamics, etc., are listed under I.1.b.

[2]Includes entries on instrumentation.

2
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The proposed procedure is applied to data collected from the original seismograms of four earthquakes recorded at seismic observatories throughout the world. The S-wave results and the previous P-wave solutions are in very poor agreement; consequently, one must conclude that one or more of the following is true: the mechanisms assumed is not the type actually occurring; the phase identified as the S-wave does not correspond to the first P-wave motion; the P-wave method is incorrect or inadequate; the S-wave method is incorrect or inadequate. Determining the most correct of these various possibilities requires a discussion of the relative merits, defects, and potentialities of the two methods.

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VESIAC No. 1602 The velocities of elastic waves and elastic constants were determined by the ultrasonic impulse method for single crystals of aegirite and hornblende. The dependence of the elastic constants of silicates on their structural features was also considered.

ALEXANDROV, K. S., and T. V. RYZHOVA, "Elastic Properties of Rock-Forming Minerals, II. Layered Silicates," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 12, pp. 1165-1168.

VESIAC No. 1621 The ultrasonic speeds and elastic constants of monocrystals of the micas muscovite, phlogopite, biotite, as well as some of the elastic constants of talc, valuevite, and chlorites, were determined by the ultrasonic-pulse method. It was found that considerable anisotropy in the structures of these layered silicates is accompanied by strong anisotropy of their elastic properties. The increased bond strength of the layers on transition from crystals of the talc group to soft and brittle micas and further to chlorites is accompanied by an increase in the corresponding elastic constants and a decrease in the elastic anisotropy of these crystals.

ALFORD, J. L., G. W. HOUSNER, and R. R. MARTEL, Spectrum Analyses of Strong-Motion Earthquakes, Calif. Inst. Tech., Pasadena, Calif., 1951.

VESIAC No. 1137
AD 208 558 The dynamic response of a structure to an earthquake has been formulated in a manner which permits separation of the characteristics of particular structures from the characteristics of the earthquake. The expression involving the characteristics of the earthquakes is defined as the "spectrum" of the earthquake; it is shown that the spectrum is simply a plot of the response versus the period of a simple oscillator. Eighty-eight such spectra, computed by means of an analog computer, are presented in the paper.

Damping is found to be a very important parameter in the overall problem; relatively small amounts of damping reduce structural response sharply. When damping is considered, the spectra are shown to be consistent with the hypothesis of a distribution about a mean value. It is concluded that the concept of a "dominant ground period" is not valid for the purpose of a seismic structural design. Further research on damping in buildings is recommended, and it is proposed that the

mean value of a damped spectrum be used as a quantitative measure of earthquake intensity.

ALSOP, L. E., G. H. SUTTON, and M. EWING, "Free Oscillations of the Earth Observed on Strain and Pendulum Seismographs," J. Geophys. Res., 1961, Vol. 66, No. 2, pp. 631-641.

VESIAC No. 1897 Spectral analyses of seismograms of the great Chilean earthquake of 22 May 1960 from a newly installed strain seismograph at Ogdensburg, New Jersey, and from pendulum seismographs at Palisades, New York, have revealed spectral peaks corresponding to fundamental spheroidal modes 2 to 34, fundamental torsional modes 2 to 9, and the first overtone of the second spheroidal mode. Other peaks, some of which may be overtones, occur in the spectra but are not yet identified. Amplitudes of some observed spectral peaks vary radically between two time intervals on the same record. The peaks do not decrease in amplitude according to any simple law, and the amplitude rarely increases with time; these observations indicate the apparent acquisition of energy in the mode between the time intervals. The periods of the graver modes of oscillation, both spheroidal and torsional, are in agreement with the theoretical values of Alterman, Jarosch, and Pekeris. The periods of the fundamental spheroidal oscillations between 250 and 500 seconds have been determined very accurately. These periods show excellent agreement with theoretical values calculated by Bolt and Dorman for a mantle with velocities according to the Gutenberg model and densities according to the Bullen model A. Also, phase velocities obtained from these periods are in agreement with Rayleigh-wave phase velocities observed directly from the same earthquake by Brune, Nafe, and Alsop. Good agreement is also observed between torsional periods and theoretical values of Sato, Landisman, and Ewing, which are based on velocities of Jeffreys and densities of Bullen model A.

ALSOP, L. E., G. H. SUTTON, and M. EWING, "Measurement of Q For Very Long Period Free Oscillations," J. Geophys. Res., 1961, Vol. 66, No. 9, pp. 2911-15.

VESIAC No. 1053 This article explains the radical amplitude variation with time of long-period spectral peaks corresponding to the periods of free oscillation. The variation arises from the rotation of the corresponding standing-wave pattern with respect to the earth. The modulation caused by this rotation imposes certain conditions on the length of record and the interval between records used to measure Q by observing the amplitude decrement. Under these conditions the Q for the ${}_0S_2$ mode is found to be 370, and about 300 for the ${}_0T_5$ mode. These values are contrasted with other values of Q obtained by various authors for other free periods. Q appears to be constant for modes ${}_0S_2$ through ${}_0S_9$.

ALTERMAN, Z. See Pekeris, C. L.

ALTSCHULER, L. V., and S. B. KORMER, "On the Internal Structure of the Earth," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 1, pp. 18-21.

VESIAC No. 1540 This paper presents conclusions on the internal structure of the Earth derived from data on the percussive and isentropic compressibility of metals, and gives new results on the measurement of the percussive compressibility of olivine and iron pyrites. A comparison of the speed of sound in iron at high pressures and the velocities of seismic waves confirms Bullen's hypothesis of the solid nature of the inner core and indicates the chemical uniformity of the core. The dependence of the density of iron and nickel on pressure in a region corresponding to the outer core does not coincide with Bullen's calculated dependencies, nor does it fall within the Rado-Molodenski limits at the boundary of the outer core.

Their studies of the percussive compression of olivine did not lead the authors to conclude that phase transformation in it was possible, as is assumed by Lodochnikov and Ramsey. Preference should therefore be accorded to the hypothesis that the core of the Earth is composed of iron ore.

ANDERSEN, W. H., and R. B. PARLIN, New Approaches to the Determination of the Thermodynamic-Hydrodynamic Properties of Detonation Processes, Tech. Rept. No. 28, Inst. Study of Rate Processes, Univ. of Utah, Salt Lake City, Utah, 1953.

VESIAC No. 275
AD 25 940 This study was undertaken in part to arrive at a quicker and more serviceable, (though less exact) method of obtaining the Chapman-Jouguet surface. Equations are presented which help in choosing models with which to evaluate the unknown parameters for a given explosive. The value of the detonation properties obtained appear to be quite good in view of the simplicity of the treatment. The agreement between calculated and observed values of the detonation velocities is quite good. Further investigation is needed to determine how useful the method is for explosives not containing carbon.

ANDREEV, S. S., "A Study of the Plutonic Structure of the Earth's Crust Using PS Exchange Waves Recorded During Earthquakes," Bull. Acad. Sci. USSR, Geophys. Ser, 1957, No. 1, pp. 22-31.

VESIAC No. 1661 This paper presents a method for the study of the structure of the earth's crust using PS-type exchange waves on records of earthquakes. This method was used in southwest Turkmen; results are included in the paper.

ANDREEV, S. S., "The Use of Epicentral Lines When the Velocity Profile is Unknown," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 7, pp. 637-643.

VESIAC No. 1587 Straight epicentral lines determined from the true travel times of seismic waves for an unknown velocity profile are discussed. It is shown that all the lines pass through the center of a circle running through three stations and their position in relation to these stations

is determined by the value of the parameter K (the ratio of the differences between the time squares). Simple methods of constructing K-epicentrals and epicentrals with the parameter q (the ratio between the differences in arrival times at the three stations) are suggested. The latter can be replaced by K epicentrals, which are simpler to construct The extent of error in the K and q methods respectively is assessed.

AOKI, H., "Seismic Waves in the Region Near Explosive Origin," J. Earth Sci., 1960, Vol. 8, No. 2, pp. 120-173.

VESIAC No. 1805 This paper describes experimental and theoretical investigations of the shape of seismic waves radiated from an explosive seismic origin and the mechanisms of wave generation. Experiments concerning the symmetric character of elastic waves show that the nearly spherical waves which are initially generated at the seismic origin are so profoundly affected by the inhomogeneity of superficial structures of the medium that the deviation of waveform from spherical symmetry is detected on the ground surface; the smaller the amount of charge, the more the amplitude fluctuates. The form and the propagation of elastic waves preceding the plastic wave front are discussed with regard to wave generation. It is concluded that the ratio $2/\mu$ and the expansion of the plastic region are important factors in determining the shape of an elastic wave.

ARCHANGEL'SKY, V. T., "Questions Concerning the Theory of the Long-Period Vertical Seismometer," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 10, pp. 955-960.

ARKHANGEL'SKAYA, V. M., "Damping of Surface Rayleigh Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 8, pp. 738-743.

VESIAC No. 1595 This paper gives the results of determining the damping factor of surface waves y and of the internal friction of rocks in the earth's mantle 1/Q. The determinations were made from Rayleigh wave traces (with a period of 22-24 and 320 seconds) which had traveled round the globe several times from two violent earthquakes ($M \sim 8$) recorded by a long-period seismometer at the Moscow Seismic Station.

ARKHANGEL'SKAYA, V. M., "Investigation of Short-Period Surface Seismic Rayleigh Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 8, pp. 725-732.

VESIAC No. 1593 This paper investigates short-period (5-13 seconds) surface Rayleigh waves. Five groups of waves, propagating with group velocities of 4.0, 3.67, 3.57, 3.41, and 3.29 km/sec, are shown to exist. A study is made of the dispersion of waves of the first group, the so-called M_2 wave.

VESIAC No. 1515 The theory of suspension of the pendulum for a vertical seismometer is considered; basic terms in the equation of motion of the pendulum

are shown which describe the instability of the pendulum when its period is increased.

ARKHANGEL'SKY, V. T., D. P. KIRNOS, I. I. POPOV, and V. N. SOLOV'EV, "Observations of Long-Period Seismic Waves at the Simferopol Station," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 5, pp. 435-438.

VESIAC No. 1567 A brief description is given of a model of a vertical seismograph for recording seismic waves with periods of 20-300 seconds. Tests of this instrument are cited and some results of observations made with it at the Simferopol seismic station are reported. During the Chilean earthquake of 22 May 1960, the instrument recorded waves with periods up to 480 seconds.

ARMOUR RESEARCH FOUNDATION (Staff), Evaluation of Temperature Distribution and Yield of an Underground Explosion, Armour Res. Found., Chicago, Ill., no date.

VESIAC No. 260 Temperature distribution as a function of time in the immediate vicinity of a nuclear explosion may be useful in calculating the yield of the bomb. A hypothetical situation approximating the expected real situation (the explosion of the nuclear device in its environment) is set up, and equations for it worked out to indicate how the temperature of the planned explosion can be measured without damaging or losing the measuring equipment in the explosion.

It is concluded that, at present, the only way in which bomb yield can be calculated from temperature measurements is to wait until the cavity (where the bomb has exploded) and the surroundings have cooled to temperatures that are measurable, and then to measure the temperature versus distance from the center of the cavity at several different times after the explosion. Sampling the soil at different times and places may make it possible to correct for vapor migration, if any, from the heated area around the explosion.

ASADA, T., Z. SUZUKI, and Y. TOMODA, "On Frequency Distribution of Seismic Magnitude," Bur. central seismol. internat. Pubs. ser. A, Travaux sci., 1956, No. 19, pp. 95-98.

VESIAC No. 1643 The frequency distribution of magnitude of large earthquakes has been calculated by Gutenberg and Richter and others (see Geophys. Abs. 153-14521, 157-89). It is usually impossible to determine the magnitude of minor shocks ($M < 4$) because they are seldom registered simultaneously at several stations. However, it is possible to obtain the frequency distribution of maximum trace ampiitude.

It is concluded that a frequency curve of similar magnitude can be applied both to earthquakes with $M > 6$ and to minor aftershocks with $M < 0$. (The weakest earthquake observed in Japan was -1 in magnitude with 10^{10} ergs of energy.) A discussion of energy frequency distribution and partition, based on published works, concludes the paper.

ATCHISON, T. C. See Duvall, W. I.

AUBERGER, M., and J. S. RINEHART, Ultrasonic Velocity and Attenuation of Longitudinal Waves in Rocks, Colorado School of Mines Res. Found., Golden, Colo., 1960.

VESIAC No. 1760 Hughes pulse technique for measuring longitudinal velocities has been adapted and extended to measure attenuation of longitudinal waves in the frequency range from 250 kcs to 1,000 kcs. Data for velocity and attenuation in eight different rocks (three granites, one porphyry, two sandstones, one limestone, and one marble) are given at eight different frequencies ranging from 250 kcs to 1,000 kcs. The values of attenuation measured have been found much higher than for metals and plastics in the same frequency range. They lie between 1 and 37 db per centimeter. All the curves of attenuation versus frequency show one or several peaks, none of the curves indicating a marked law of increase or decrease of attenuation with frequency. In one granite, in the limestone and in the marble, successive peaks occur at harmonic frequencies. A comparison between the wavelengths for which the peaks occur and the grain size of the rocks shows a good agreement for the coarse-grained rocks between the frequencies of occurrence of the peaks and the resonance frequencies of the largest crystals of the rocks; this indicates a very large effect of the frictional boundary losses on attenuation when the wavelength approaches the grain size of the rock.

AVER'YANOV, A. G., et al., "Deep Seismic Sounding in the Zone of Transition from the Asian Continent to the Pacific Ocean During the IGY," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 2, pp. 109-117.

VESIAC No. 1544 The article describes the methods of the observations and the equipment used in carrying out deep seismic sounding in the transition zone between the Asian Continent and the Pacific Ocean during the IGY. A characteristic of the seismic recordings obtained is adduced. On the basis of an analysis of the factual material, seismograms, and travel-time curves, the dissimilarity in the crust structure of the territory investigated is presented. Sectors having continental, oceanic, and transitional type of structure of the earth's crust are isolated.

AVSYUK, YU. N. See Sorokhtin, O. G.

BABICH, V. M., and A. S. ALEKSEEV, "A Ray Method of Computing Wave Front Intensities," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 1, pp. 9-16.

VESIAC No. 1249 Equations which give a geometric approximation for the case of nonstationary waves in an inhomogeneous elastic medium are obtained with the aid of the theory of generalized functions; analogous equations are obtained by expanding stationary solutions for the case of high frequencies. Assumptions which permit the application of the equations developed in this paper to a large class of wave intensities are elaborated.

BAILEY, L. F. See Melton, B. S.

BAKER, G. T. See Lake, H. R.

BAKER, R. G., A Study of Early S Motion, Master's Thesis, St. Louis Univ., St. Louis, Mo. 1956.

VESIAC No. 1166
AD 93 454
A detailed particle-motion study was made of 88 phases from 53 shocks. Magnification of the records was obtained by projecting them with an opaque projector onto rectangular coordinate paper. The enlarged trace was copied accurately and the amplitudes of the 2 displacements (east-west and north-south) at each point were plotted on coordinate paper to give the position of the earth particle at the station at a particular time. Results indicated that the eS motion is usually transverse and definitely part of the S phase. Refracted longitudinal phases, which result from S-waves striking discontinuities at moderate depths, precede the S phases in enough strength to be recorded on some seismograms. Although there appeared to be some evidence to support the hypothesis that the early S motion is a result of polarization which causes SH waves to arrive ahead of SV waves, there was no apparent pattern to such occurrences.

BALAKINA, L. M., "The Distribution of Stresses Effective in Earthquake Foci in the Northwestern Pacific," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1131-1135.

VESIAC No. 1433 The determination of stresses occurring in the foci of 24 earthquakes in the northwestern Pacific is used for delineating a series of regularities in the distribution of main stresses in the crust and upper parts of the earth's mantle in a given seismic region.

BALAKINA, L. M. See Vvedenskaya, A. V.

BALASHOV, D. B. See Volarovich, M. P.

BALAVADZE, B. K. and G. K. TVALTVADZE, "The Structure of the Earth's Crust in Georgia According to Geophysical Data," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 9, pp. 623-628.

VESIAC No. 1297 This paper presents the results of a study based on seismic and gravity data, of the earth's crust structure in the territory of Georgia.

BALSINGER, D. F. See Twenhofel, W. S.

BARDEEN, T., "Crystal Shaketable for Geophone Studies," J. Geophys. Res., 1950, No. 15, pp. 456-461.

VESIAC No. 1828 A comparison is made between shaketables driven by piezoelectric crystals and those of conventional design. The general construction of crystal shaketables and the auxiliary equipment necessary for geophone studies are discussed. The theory of geophone motion shows that a

measurement of phase shift between the geophone output and the crystal-shaketable driving voltage can be used to determine the natural frequency and damping of the moving mass of the geophone. The crystal shaketable gives a simple method for routine testing of geophones both in the laboratory and in the field.

BARR, K. G., "The Use of a Selective Amplifier to Increase the Useful Sensitivity of Short Period Seismographs," Bull. Seis. Soc. Am., 1962, Vol. 52, No. 2, pp. 455-461.

VESIAC No. 1793 A frequency selective amplifier has been developed to increase the useful sensitivity of short-period electromagnetic seismographs to nearby earthquakes. The result has been to reduce the magnitude of the smallest earthquake detectable by about two units, and to reduce the magnitude of the smallest earthquake for which an accurate arrival time can be given by 1/2 to 1 unit.

BÅTH, M., "Crustal Structure of Iceland," J. Geophys. Res., 1960, Vol. 65, No. 6, pp. 1793-1807.

VESIAC No. 1880 A report is given of the results of a seismic field investigation in 1959 of the crustal structure of Iceland. Explosions were made at a depth of 30 meters in Graenavatn, a crater lake in southwest Iceland, and recordings were made with a 12-channel refraction apparatus at a number of stations along two profiles across Iceland, one profile across the center of the island and another in the western part. A three-layered crust was found—a top layer of lava and volcanic ash and two basaltic layers. The longitudinal wave velocities are 3.69, 6.71, and 7.38 km/sec, respectively, and the layer thicknesses 2.1, 13.7, and 10.0 km, respectively. The total crustal thickness down to the Mohorovicic discontinuity is about 27.8 km. Direct waves through the various layers, as well as reflected waves, are used in the study. Longitudinal guided waves, propagated by multiple reflections in the lava layer, were recorded out to distances of over 100 km. As a consequence of the large velocity contrast between the lava layer and the first basaltic layer, more than 83.5 per cent of the original seismic energy remains in the lava layer, leaving only a few per cent to penetrate deeper. Amplitude attenuation coefficients have been determined, which are about twice as large for the central profile as for the western profile. The main reason for the strong attenuation along the central profile is scattering of the waves in the inhomogeneous and heavily fractured crust. The seismic efficiency of the explosions, all carried out in the same way, varies in the mean by 20 to 25 per cent, as evidenced by the records of the Reykjavik seismograph station.

BÅTH, M. See Tryggvason, E.

BECKMANN, W. See Press, F.

BELOTELOV, V. L., and N. V. KONDORSKAYA, "On the Question of Determination of the Energy of Earthquakes," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 12, pp. 1164-1172.

VESIAC No. 1534 This paper presents the results of the determination of the energy of longitudinal and transverse waves for ten Far Eastern earthquakes, using a method which had been suggested earlier by the authors. The results that were obtained agree with the energy values that had been calculated by means of a formula of Gutenberg and Richter, which is based upon the determination of the magnitude M for the earthquakes in question.

An attempt is made to construct an "energy Hodograph"; there is a general tendency for the increase of lg E with an estimated epicentral distance for P and S waves.

BELOTELOV, V. L., and N. V. KONDORSKAYA, "Relationship Between Earthquake Energy and Maximum Velocity of the Oscillations in Body Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 1, pp. 22-26.

VESIAC No. 1541 This paper examines the relationship between the energy of an earthquake, as determined by the authors, and the maximum oscillation velocity of the longitudinal and transverse waves. The energy values derived are compared with the energy values found for the same cases by means of special formulas. The energy differences of deep-focus and shallow earthquakes of equal magnitude are discussed.

BENIOFF, H., "Long Waves Observed in the Kamchatka Earthquake of November 4, 1952," J. Geophys. Res., 1958, Vol. 63, pp. 589-593.

VESIAC No. 450 The recording of long-period waves on an electromagnetic strain seismograph during the Kamchatka earthquake is discussed. Special attention is given to analysis of G wavelets and the performance of the instrument.

BENIOFF, H., "Orogenesis and Deep Crustal Structure—Additional Evidence from Seismology," Bull. Geol. Soc. Am., 1954, Vol. 65, pp. 385-400.

VESIAC No. 455 Seismic studies of various tectonically active regions are found to supplement the conclusion that the mechanism of orogenesis responsible for each of the great linear and curvilinear mountain ranges and oceanic trenches involves a complex reverse fault. Two types of faulting, oceanic and marginal, occur in these regions. A hypothesis is offered for the origin of volcanoes associated with the faults.

BENIOFF, H., "Seismic Evidence for Crustal Structure and Tectonic Activity," in Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., 1955, pp. 61-74.

VESIAC No. 458 Seismic data obtained from numerous regional earthquake sequences are analyzed. Conclusions about crustal structure and tectonic activity are drawn; these are derived from geographic positions, depths of earthquake foci, and from elastic-strain rebound characteristics of earthquake sequences. The author notes an apparent increase in the rate of world-strain generation. Graphs, maps, and diagrams accompany the discussion. A short bibliography is given.

BENIOFF, H., "Seismological Research: Caltech and the IGY," Eng. and Sci. Monthly, Oct. 1957.

VESIAC No. 461 One of the IGY projects conducted by Caltech's Seismological Laboratory is the construction of two fused-quartz extensometer installations in South America. They will provide three kinds of observational data: measurements of secular strain changes in the Andes, measurements of earth tidal strains, and recording of the earth excited by earthquakes. It is possible that measurements of secular strains at an adequate number of stations over a long enough time intervl may permit determining the strain-pattern habit of a region and provide the basis of earthquake prediction. The time required for such a study may run into several centuries.

BENIOFF, H., et al., "Searching for the Earth's Free Oscillations," J. Geophys. Res., 1959, Vol. 64, No. 9, pp. 1334-1337.

VESIAC No. 465 This article reports an attempt to detect spectral peaks associated with the earth's free oscillation. Such study could be important for studying distribution of elastic (and anelastic) properties within the earth. The especially sensitive instruments used were a La Coste and Romberg tidal gravimeter at Glendora, Calif., and at Saigon, Vietnam, and a Benioff extensometer at Isabella, Calif. Atmospheric disturbances and nonlinear tidal effects must, to some extent, excite the free oscillations even in the absence of earthquakes. By taking suitably sensitive and suitably long records, one can expect that eventually the narrow peaks of the free oscillation can be detected over and above the broad noise spectrum. Virtually all of the record power is contained in the tides. The power spectrum of the records was computed according to the method of Tukey (Blackman and Tukey, 1958). At present the gravimeter is a more sensitive indicator of free oscillations than the extensometer.

BENIOFF, H., M. EWING, and F. PRESS, "Sound Waves in the Atmosphere Generated by a Small Earthquake," Proc. Nat. Acad. Sci. U. S., 1951, Vol. 37, No. 9, pp. 600-603.

VESIAC No. 447 This report treats the first analyzed case, it is believed, of air-coupled waves from a natural earthquake. Phase and group-velocity curves are presented for air-coupled Rayleigh waves. The depth of the weathered layer required to produce air coupling at a period of 0.9 second is calculated at approximately 100 meters. The Rayleigh waves of period 0.9 second traveled at a speed of 0.10 km/sec, radiating compressional waves into the air. Approximately, these sound waves reach a height of 40 km with a mean velocity of 0.305 km/sec and travel the horizontal distance to Pasadena at a speed of 0.326 km/sec before descending. Results illustrate a fundamental reciprocity principle of observation of air-coupled waves. A disturbance in the air could produce a similar train of waves in the earth.

BENIOFF, H. and B. GUTENGERG, "Progress Report, Seismological Laboratory, California Institute of Technology, 1951," Trans. Am. Geophys. Union, 1952, Vol. 33, No. 5, pp. 759-762.

VESIAC No. 449 This report treats routine observations of local and distant earthquakes, station instrumentation changes and relocations, seismological instrument development (e. g., instruments for the study of microseisms, surface waves, SV and SH), earthquake sequence study (Benioff), and artificial explosions and wave velocities in the surface layers. A list of the Laboratory's publications for 1951 and a bibliography are included.

BENIOFF, H., and B. GUTENBERG, "Strain Characteristics of the Earth's Interior," in Internal Constitution of the Earth, 2nd Ed., Dover Publications, Inc., New York, N. Y., 1951, pp. 382-407.

VESIAC No. 432 Elastic strains in the earth are discussed in terms of the classical approach derived from the analysis of time-dependent strains. Coefficients of viscosity and coefficients of internal friction are shown to be similar for relatively fast movements in fluids and extremely slow movements in solids. The strength of material of various rocks and the viscosities of various substances are tabulated. Corroboration of these v lues and values for the crust and core of the earth are derived from studies of the periods of seismic waves, body waves, and the rate of post-glacial uplift. Empirically derived general curves of strain versus time and of stress versus time for materials capable of elastic creep and of elastic flow are presented. These creep characteristics are applied to the analysis of the sequence in time of the magnitudes of earthquakes and of after-shocks.

BENIOFF, H., B. GUTENBERG, F. PRESS, and C. RICHTER, "Progress Report, Seismological Laboratory, California Institute of Technology, 1955," Trans. Am. Geophys. Union, 1956, Vol. 37, No. 2, pp. 232-238.

VESIAC No. 459 This article discusses reports on station development, instrument development (a vertical-component seismograph, tubeless photocell-galvanometer amplifier, quartz-crystal clock by Benioff and model seismology by Press), long-period G waves (Benioff), local phase velocity (Press), crustal structure from gravity data (Tsuboi), Lg waves in California (Press), correlation of "storms" of microseisms with earthquake Rayleigh waves (Air Force-sponsored project), magnitude and energy of earthquakes (Gutenberg and Richter), energy of earthquakes (Gutenberg), unidirectional faulting (Richter), Desert Hot Springs earthquake (Richter and Allen), anelastic properties of rocks (Lomnitz), electromagnetic oscillations (Benioff and Press), Kern County aftershocks, seismicity in general, and observations of local and distant earthquakes (Richter). Publications are listed.

BENIOFF, H., B. GUTENBERG, F. PRESS, and C. RICHTER, "Progress Report, Seismological Laboratory, California Institute of Technology, 1956," Trans Am. Geophys. Union, 1957, Vol. 38, No. 2, pp. 248-254.

VESIAC No. 460 This article covers reports on station development, instrument development, IGY participation, mantle-crustal Rayleigh Waves, Channel P waves in the earth's crust, low-velocity layers, rigidity of earth's core, damping of the earth's free nutation, seismic activity 1897 to 1904, earthquake energy, volume and aftershocks and strength

of the earth's crust, travel times at short distances, crustal structure at the continental margin, effects of ground on shaking, seismicity of the earth, Agua Blanca shocks, local earthquake statistics, model seismology, microseisms, electromagnetic oscillations.

BENIOFF, H., B. GUTENBERG, and C. RICHTER, "Progress Report, Seismological Laboratory, California Institute of Technology, 1949," Trans. Am. Geophys. Union, 1950, Vol. 31, No. 3, pp. 463-467.

VESIAC No. 443 Seismological instrument development (chiefly under Benioff), studies on earthquakes and rock creep, data from a surface explosion (Corona, Calif., 6 August), P Wave behavior, a reinterpretation of Southern California earthquakes (1933-1941) by Gutenberg, seismic-wave research by Denson, Ergin and Dehlinger, and two earthquakes occurring in 1949 (Terminal Is., Calif. and Queen Charlotte Is., B. C.) are discussed. A list of Laboratory publications which appeared in 1949 is included.

BENIOFF, H., B. GUTENBERG, and C. RICHTER, "Progress Report, Seismological Laboratory, California Institute of Technology, 1950," Trans. Am. Geophys. Union, 1951, Vol. 32, No. 5, pp. 749-754.

VESIAC No. 446 This report lists papers published during 1950. It describes instrument development (under Benioff), development of stations, and investigation of seismic-wave behavior at the core (by Gutenberg and Ergin), and mentions determination of magnitudes and epicenters supplementary to "Seismicity of the Earth" (by Gutenberg and Richter) with mention of particular shocks.

BENIOFF, H., B. GUTENBERG, and C. RICHTER, "Progress Report, Seismological Laboratory, California Institute of Technology, 1952," Trans. Am. Geophys. Union, 1953, Vol. 34, No. 5, pp. 785-791.

VESIAC No. 453 This article assesses data resulting from the Kern County (Calif.) earthquakes (main shock 21 July 1952), instrumental development by Benioff (capacity transducer seismograph, hot stylus recorder), reduced sensitivity in the long-period strain seismograph, the project sponsored by the Geophys. Res. Div. of the Air Force Cambridge Res. Cen., and research work on the low-velocity layer (Gutenberg). Travel-time curves (Shor) for local shocks in Southern California are presented graphically. Laboratory publications for 1952 are listed.

BENIOFF, H., B. GUTENBERG, and C. RICHTER, "Progress Report, Seismological Laboratory, California Institute of Technology, 1953," Trans. Am. Geophys. Union, 1954, Vol. 35, No. 6, pp. 979-987.

VESIAC No. 456 Discussion, with graphs and diagrams, of the Kern County earthquake sequence (1952-1953) is continued. Some modification of preliminary conclusions in the previous progress report is made. Studies of blasts directed to searching for waves reflected from the Moho, instrument development (quartz crystal clock, fused-quartz strain

meter, long-period vertical-component seismometer), the Geophys. Res. Div. project, long-period and other seismic wave research, and postglacial uplift studies are discussed. Laboratory publications appearing in 1953 are listed.

BENIOFF, H., B. GUTENBERG, and C. RICHTER, "Progress Report, Seismological Laboratory, California Institute of Technology, 1954," Trans. Am. Geophys. Union, 1955, Vol. 36, No. 4, pp. 713-718.

VESIAC No. 457 This report includes discussion of station and instrument development (under Benioff, Blayney and Lehner), the Geophys. Res. Div. project, magnitude-energy relationships, Gutenberg's study of low-velocity layers, geophysical elements in isostatic calculations, student research work on wave travel times and magnitudes, and observations of local and distant earthquakes. A bibliography and list of Laboratory publications are given.

BENIOFF, H., and F. PRESS, Seismic Surface-Wave Studies and Seismograph Development, Semi-Ann. Rept. No. 2, Contr. AF 49(638)910, Calif. Inst. Tech., Pasadena, Calif., 1962.

VESIAC No. 976 VU This report covers research in fields of instrumental, experimental, and theoretical seismology, and of pulse propagation in the atmosphere. A short-period seismograph sensitive to earth rotations is being designed to discriminate between shear and compressional waves. A three-axis digital seismograph has been built and tested. A model seismology multipulser, used to simulate the shear propagation of a fault rupture, is in operation.

Many of the Nevada underground explosions were recorded. The nature of transverse wave motion produced by explosions is being studied, as are the spectra of surface waves of earthquakes and underground explosions.

The effect of source depth on surface wave dispersion is being studied. The theory of elastic wave propagation in layered media has been extended to include the effect of anisotropy in each layer.

An attempt is being made to account for the shape of the atmospheric pulse (gravity-acoustic) recorded from the Soviet megaton explosions. The problem of the radiation of seismic waves from a pressurized spherical cavity in an elastic half-space is also being treated, in connection with the use of large cavities to reduce seismic waves from underground nuclear explosions.

BENIOFF, H. See Brune, J. N.

BENNETT, R. R., and A. S. FULTON, "The Generation and Measurement of Low-Frequency Random Noise," J. Appl. Phys., 1951, Vol. 22, No. 9, pp. 1187-1191.

VESIAC No. 1226 Judgment of the performance of automatic control systems often involves a consideration of the behavior of such systems in the pres-

ence of random noise. The noise may be undesirable, such as receiver noise, or it may represent an ensemble of statistical inputs which the system is to follow. Analytical techniques exist for determining the response of linear systems to noise inputs. However, no general methods are available for analyzing nonlinear systems subject to noise inputs. An electric analog computer, together with a suitable source of noise, may be used to study nonlinear systems. This paper describes an electronic noise generator designed for analog-computer or simulator use. Methods are discussed for measuring the important characteristics of low-frequency noise, such as the mean value, spectral density, amplitude distribution, and autocorrelation. Particular attention is devoted to the length of time necessary to extablish satisfactory estimates of the properties of low-frequency noise.

BENTLY, C. R. See Sutton, G. H.

BERGER, P. R. See Leet, L. D.

BERGMANN, P. G., et al., The Physics of Sound in the Sea, Off. Sci. Res. and Dev., Nat. Def. Res. Comm., Washington, D. C., 1946.

VESIAC No. 1746
AD 32 853

Four years of research on underwater-sound phenomena were undertaken to provide a firmer foundation for the design and use of sonar equipment. A knowledge of the manner in which sound is generated, transmitted, reflected, received, and detected is useful in the design and development of sonar. Experimental investigations were made of the structure of the superficial layer of the ocean and its effect on the transmission of sonic and supersonic vibrations. The relation of such basic factors to the performance of sonar is emphasized. Many tactical rules embodied in submarine and antisubmarine doctrine were directly based on information obtained in these basic studies.

BERNSTEIN, V. A., "The Stress at the Boundary Between the Mantle and the Earth's Crust Generated by Convection in the Mantle," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 9, pp. 920-928.

VESIAC No. 1412

This article considers the steady convection in the spherical layer of thickness 400-450 km forming the upper part of the mantle which occurs in the presence of a stable temperature gradient at a constant depth. Formulas are obtained for the components of the stress at the boundary between the mantle and the earth's crust. The temperature distribution used for the calculations is that obtained as an approximate solution of the problem of finding the earth's temperature by a consideration of the variation in the content of radioactive elements in the continental and the oceanic crust. This procedure yields a tangential stress component of the order of $\sim 10^6$ dyne/cm^2.

BERSON, also spelled Berzon.

BERSON, I. S., "Experimental Data on Converted Refracted PSP Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 6, pp. 397-406.

VESIAC No. 1278 This is a report on recordings obtained in a study on refracted-wave correlations, of converted (longitudinal-transverse) refracted PSP waves. The kinematic and dynamic characteristics of PSP waves are discussed, and it is pointed out that they show a greater variability than longitudinal-refracted PPP waves.

BERSON, I. S., "Some Spectral Characteristics of Waves Reflected From Thin Layers," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 5, pp. 453-461.

VESIAC No. 1364 Kinematic and dynamic conditions are examined under which, in determining the spectra of reflected waves, one may use Rayleigh's formulas, obtained for plane sinusoidal stationary waves reflected from a thin layer (the acoustic case). Based on an analysis of these formulas the author examined the spectral characteristics of reflected waves with different velocity differentiation of the medium and at different angles of incidence of the waves onto a thin layer. The effect of absorption in the medium covering the thin layer on the spectra of the reflected waves is also considered.

BERSON, I. S., YU. I. VASSIL'EV, and S. P. STARODUBROVSKAYA, "Wave Refraction by Aquiferous Sands. I," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 1, pp. 17-29.

VESIAC No. 1321 This paper discusses an experimental study of the kinematic and dynamic properties of refracted waves related to a layer of aquiferous sands. It is pointed out that certain frequency characteristics of such waves provide means of distinguishing layers of aquiferous sands from other rocks with similar velocities. The absorption coefficients of waves propagating in aquiferous sands vary within a wide range, while interface velocities undergo only slight changes.

BERSON, I. S., YU. I. VASSIL'EV, and S. P. STARODUBROVSKAYA, "Wave Refraction by Aquiferous Sands. II," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 2, pp. 115-118.

VESIAC No. 1326 The authors discuss the causes of the considerable variability of the absorption coefficients of seismic waves in sand layers at small interface velocity changes observed during experimental investigations. It is shown that these peculiarities may be explained with changes in the physical properties of the sand (porosity and mechanical composition).

BERZON, I. S., and I. I. RATNIKOVA, "On the Nature of Certain Waves Obscuring Detection of Reflected Waves on the Russian Plateau," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 6, pp. 1-15.

VESIAC No. 1685 This article discusses the results of experiments to determine the types of certain interfering waves detectable on seismic-reflection records on the Russian Plateau. It is shown that the waves in question belong to the class of alternating refracted waves which propagate along a refracting boundary in the form of transverse waves; they pass part of the path in the top medium as transverse waves and part of it as longitudinal waves.

BIRCH, F., "Physics of the Earth," in Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., 1955, pp. 101-118.

VESIAC No. 1041 Several aspects of the physics of the crust may be distinguished for convenience, though they are necessarily interrelated: the physical methods employed in the field to discover structure (i. e., gravitational, seismic); the physical measurements of properties of geological materials required for the interpretation of field observations in terms of composition; the physical conditions, such as pressure and temperature, which influence these properties; the physical processes, particularly the transformations of energy, which give rise to geological dynamics.

BIRCH, F., "Travel Times for Shear Waves in a Granitic Layer," Bull. Seis. Soc. Am., 1938, Vol. 28, No. 1, pp. 49-56.

VESIAC No. 1884 Travel times for shear waves in a layer of granite have been computed on the basis of recent laboratory work which permits an approximate evaluation of the variation of velocity with depth. The results are found to agree very closely with those found for New England by Leet using the method of timed blasts. The mean surface velocity of shear waves in granite having their focus at the surface is computed to be 3.52 km/sec at 568 km, decreasing to 3.26 at 25 km. The curvature is shown to be too small to be easily recognized from records of near earthquakes. A depth of 15 km for the granitic layer is shown to be consistent with Leet's observations of pulses through a second layer.

BIRD, G. A., "The Motion of a Shock Wave Through a Region of Non-Uniform Density," J. Fluid Mech., 1961, Vol. 11, Pt. 2, pp. 180-186.

VESIAC No. 894 The method of characteristics is used to calculate numerical solutions for the one-dimensional motion of a plane shock wave through a stationary gas which contains a region of nonuniform density. These solutions are compared with those given by the Chisnell-Whitham approach, which ignores the effects on the shock wave of the disturbances which are generated in the flow behind it, and also with the asymptotic solution given by the simple theory which regards the nonuniform region as a contact-surface discontinuity. It is concluded that the results of the simplified theories must be applied with caution.

BIRKENHAUER, H. F., "A Statistical Study of Blast Vibrations," Earthquake Notes, 1957, Vol. 28, pp. 14-15.

VESIAC No. 970 This paper discusses the control limits of blasts; that is, it treats a large number of blasts and seeks to set limits beyond which the blast characteristics will not range. The author investigated displacements recorded from several hundred quarry blasts at St. Louis, Mo. For this study he concentrated his attention on the data from amplitudes measured at 1300 feet and 3700 feet for blasts totaling 750, 800, 850, 900, 950, 1000, 1050, 1100, and 1150 pounds. He found an average value for each explosive weight and distance. He applied statistical tests to the displacements measured, found excellent statistical control, and concludes that variability from blast to blast was due to chance causes

alone. The writer concludes further that because of its value in estimating the likelihood of damage, displacement is an important quantity to be measured in studies of quarry blast vibrations; and, for a given series of blasts, as long as statistical control obtains, the vibrations can be sampled rather than completely recorded—unless control is lost. A table of control constants is given.

BIRKENHAUER, H. F., R. J. ORR, and T. J. YULE, "Statistical Analysis of Accelerations from Small Blasts," Earthquake Notes, 1960, Vol. 31, pp. 29-33.

VESIAC No. 917 The methods of statistical quality control are applied to the predictions of acceleration and frequency due to blasting explosions at different distances from the point of measurement. Accelerations show a predictable range of variation under restricted conditions. Changes of location, with distance held constant, produce variations in the record because of variations in the terrain.

BJORK, R. L., "Analysis of the Formation of Meteor Crater, Arizona: A Preliminary Report," in Proc. Geophys. Lab. Cratering Symposium, Part II, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1146-M A theoretical study is made of the cratering process accompanying the impact of a 12,000-ton iron projectile on a simi-infinite half-space of soft rock at a velocity of 30 km/sec. The constituents and velocity approximate those involved in the formation of Meteor Crater, Arizona. The assumption is that the process is hydrodynamic in nature, since the pressures generated exceed by far the strengths of the materials. At these high pressures, the compressibilities of the materials and the result that shocks are generated must be taken into account. The motion is solved by numerical means, and graphs showing details of the motion are presented. The conclusion in this preliminary report is that the meteorite had a mass of between 30,000 and 194,000 tons, the range being due to the uncertainty in the impact velocity.

BJORK, R. L. See Brode, H. L.

BLACK, M. C., E. W. CARPENTER, and A. J. M. SPENCER, "On the Solution of One-Dimensional Elastic Wave Propagation Problems in Stratified Media by the Method of Characteristic," Geophys. Prospecting, 1960, Vol. 8, No. 2, pp. 218-230.

VESIAC No. 1141 This paper describes a numerical method of solution for wave propagation in a medium whose elastic parameters and density vary with depth in any specified way. Results for a simple two-layer problem are given to illustrate the method, and the extension to problems of current geophysical interest is briefly discussed.

BLACK, R. A. See Twenhofel, W. S.

BLAKE, F. G., Jr., "Spherical Wave Propagation in Solid Media," J. Acous. Soc. Am., 1952, Vol. 24, No. 2, pp. 211-215.

VESIAC No. 1864 Divergent compressional waves in solids differ from similar waves in fluids, even though the particle displacement is parallel to the direction of propagation in both media. The wave propagating from a radially oscillating spherical cavity in an infinite solid medium sees an acoustic radiation impedance which is a function of Poisson's ratio of the medium as well as of the usual parameters. The radiation resistance has the same form as in a fluid medium, but the reactance is a negative or stiffness reactance, except at high frequencies in media of low rigidity. When an impulsive pressure is generated in the cavity, as by an explosion, the form of the radiated pulse is a damped oscillating wave train which does not closely reproduce the original pressure pulse.

BOGERT, B. P., "The Transfer Function of a Short-Period Vertical Seismograph," Bull. Seis. Soc. Am., 1961, Vol. 51, No. 4, pp. 503-513.

VESIAC No. 1790 The author locates the poles and zeroes of the transfer function of a seismograph which consists of the Geotech Model 1051 Benioff vertical seismometer and the Geotech Model 4500 galvanometer-phototube amplifier with a 5 cps galvanometer. A weighted least squares fit to the measured frequency response of the seismometer, assuming a damping ratio of 17 to 1, gives for the pole locations of the seismometer transfer functions: -10.539; -5.787 + i7.407; -5.787 - i7.407. There is a triple zero at the origin. The overall seismograph transfer function has additional poles at -22.21 + i22.21; -22.21 - i22.21; -0.06283; -29.62 + i29.62; -29.62 - i29.62; an additional zero at the origin, and a quadruple zero at infinity.

BOLT, B. A., and J. DORMAN, "Phase and Group Velocities of Rayleigh Waves in a Spherical Gravitating Earth," J. Geophys. Res., 1961, Vol. 66, No. 9, pp. 2965-81.

VESIAC No. 1054 Periods of spheroidal eigenvibrations, with order of spherical harmonic $n \geq 20$, have been computed for self-gravitating inhomogeneous spheres corresponding to a variety of earth models. The periods are used to deduce phase and group velocities for the fundamental and first higher modes of Rayleigh waves having periods less than 320 seconds. The mathematical methods, program checks, and estimations of numerical precision used in the work are presented in some detail.

BONINI, W. See Meyer, R. P.; Woollard, G. P.

BORISEVICH, E. S., "An Optical System for Photo-Recording Oscillation Processes," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 3. pp. 70-81.

VESIAC No. 1673 This paper examines an optical system which is used in certain contemporary magnetoelectric oscillographs. The system is distin-

guished by the simplicity and economy of the source of light. The system insures recordings of satisfactory quality. The method of calculation used with this optical system is set forth.

BRINK, G. S. See Wells, W. M.

BRODE, H. L., and R. L. BJORK, "Cratering from a Megaton Surface Burst," Proc. Geophys. Lab. Cratering Symposium, Part II, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1146-L Assuming a hydrodynamic model, the authors have calculated the stresses and early motions associated with the cratering of a rock medium (tuff) from a 2-megaton surface burst. The results demonstrate the basically two-dimensional geometry of such an explosion, and offer preliminary values for the pressures and motions involved. The excavating action is found to be associated with the direct shock from the bomb, and not with the loading developed by the air overpressures in the early fireball. A limited description of the method, inputs, and equation of state of rock is included. Graphical results, together with some discussion of the salient features and the various physical assumptions and limitations associated with the calculations, make up the body of this report.

BROWN, J. A. See Dorman, W. J.

BROWN, F. R. See Fortson, E. P.

BRUNE, J. N., H. BENIOFF, and M. EWING, "Long-Period Surface Waves from the Chilean Earthquake of May 22, 1960, Recorded on Linear Strain Seismographs," J. Geophys. Res., 1961, Vol. 66, No. 9, pp. 2895-2910.

VESIAC No. 1056 Phase and group velocities of mantle Love and Rayleigh waves obtained from strain seismograph records of the Chilean earthquake are presented. The velocities of mantle Rayleigh waves of period from 300 to 550 seconds agree with those predicted from periods of free spheroidal oscillation of the earth and do not show a flattening of the group velocity curve for periods greater than 380 seconds. Group velocities for mantle Rayleigh waves reach a maximum of 7.8 km/sec at a period of about 1000 seconds. Determinations of phase and group velocities of Love waves have been extended to periods of 700 seconds. The phase velocity data of Sato (1958) has been corrected for the polar phase shift. Values of phase velocities are presented for periods in the range of 60 to 700 seconds. The group and phase velocities of both Love waves and Rayleigh waves agree well with those predicted for the Gutenberg-Bullen A model of the earth. The authors verify that analysis of seismograms in terms of progressive wave trains is equivalent to analysis in terms of standing waves. In the presence of absorption, as for the earth, the analysis in terms of progressive wave trains has many advantages.

BRUNE, J., J. NAFE, and J. OLIVER, "A Simplified Method for the Analysis and Synthesis of Dispersed Wave Trains," J. Geophys. Res., 1960, Vol. 65, No. 1, pp. 287-304.

VESIAC No. 1872 A disturbance at one point of a dispersive medium resulting from an impulse applied at another point may be represented as a superposition of traveling plane waves. The phase and period of the disturbance at any instant are related by the principle of stationary phase to the phase and period of a traveling wave component. For the instantaneous phase of that traveling wave component the following equation may be written:

$$Ct - \chi = (N - \Phi_0/2\pi)\, CT$$

where C is the phase velocity, χ the distance, T the period, t the travel time, N an integer, and Φ_0 the initial phase of the traveling wave component. Since t and T may be measured from a record of the disturbance and χ may be determined, the equation may be used to compute the phase velocity as a function of period, if the initial phases are known. If distance and the dispersion are known, initial phases may be determined. The disturbance at any point may be constructed from distance, initial phases, and phase velocities. The practical use of the method is demonstrated by application to antisymmetric waves in a cylindrical rod, Rayleigh waves from United States and Russian nuclear explosions, Rayleigh waves from the Hudson Bay earthquake of January 30, 1959, and Love waves from the Fairview Peak and Fallon (Nevada) earthquakes of 1954.

BUBNOVA, V. I. See Bulin, N. K.

BUCHMANN, E., The Impulse Generated by an Underwater Explosion as a Function of Time and Depth, Rept. No. 969, David Taylor Model Basin, Navy Dept., Washington, D. C., 1955.

VESIAC No. 1191
AD 87 191 Previous underwater explosion tests against simple floating wooden targets have indicated that the initial velocity acquired by the target depends on the duration of the interaction of the shock-wave pressure in the water with the target. This interaction may be interrupted by cavitation below the target; after the cavitation closes up, the momentum of the target becomes the same as that of the water which would occupy its volume if the target were removed. New tests were conducted in such a way that the time of the action of the shock-wave pressure was varied by changing the height of the target. It was found that the initial momentum acquired by the target steadily increased with time of action over the range tested. The momentum may be considerably larger than that which is due to the initial shock-wave impulse integrated up to 6 to 10 times the time constant.

BULASHEVICH, YU. P., and R. K. KHAIRITDINOV, "On the Theory of Emanation Diffusion in Porous Media," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 12, pp. 1252-1255.

VESIAC No 1447 Convection is taken into account in the equation for the diffusion of emanation in porous media. The boundary condition for emanation con-

centration in pores is substantiated, and the methods for determining diffusion coefficients are analyzed.

BULIN, N. K., "Determination of the Depth of the Folded Basement with the Aid of Transmitted Exchange Waves of Type PS Recorded in Earthquakes," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 6, pp. 518-521.

VESIAC No. 1490 This paper discusses the possibility of identifying on seismograms of general stations the transmitted exchange wave PS, which is generated in an earthquake at the surface of the folded basement. Results are presented of the depth determination of this boundary from seismograms of local and distant earthquakes, registered by the station Bairam-Ali.

BULIN, N. K. V. I. BUBNOVA, and E. A. PRONYEAVA, "The Seismicity of Turkmeniya and Northeastern Iran in 1957-1959," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 4, pp. 342-345.

VESIAC No. 1560 This report examines data on the distribution of the epicenters of the earthquakes that occurred in 1957-1959 within the limits of Turkmeniya and the northeastern part of Iran. Data on the special features of the seismic conditions are cited.

BULIN, N. K., and E. F. SAVARENSKY, "Short-Period Seismic Surface Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 6, pp. 557-561.

VESIAC No. 1580 Observation data on short-period surface waves with low group velocities (280-800 m/sec) are discussed. It is shown that these waves are connected with a sedimentary layer 10-20 m thick.

BULIN, N. K. and E. I. TRYUFIL'KINA, "Utilization of Converted SP Waves of Local Earthquakes in Studying the Structure of the Deeper Crust," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 11, pp. 1050-1055.

VESIAC No. 1524 The authors discuss the separation of converted SP waves on seismograms of local earthquakes. They present a method for interpreting SP wave records and their utilization in crustal studies in southeastern Turkmeniya.

BUNE, V. I., "Some Results of a Detailed Study of Seismic Conditions in the Stalinabad Region in 1955-1959," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 3, pp. 237-243.

VESIAC No. 1554 This article presents the results of a study of the connection between the foci of earthquakes and the basic fractures, compares the parameters of the seismic conditions determined by short and long observations, and gives a comparison between the maps of seismic activity and maps of the isoseists according to macroseismic data.

BUROVA, A. V. See Ogurtsov, K. I.

BURROWS, L. J., Earthquake Magnitude Evaluation at Florissant, Master's Thesis, St. Louis Univ., St. Louis, Mo., 1954.

VESIAC No. 1012
AD 64 190

This thesis suggests an earthquake-magnitude scale based on seismograms of St. Louis and Florissant, Missouri. The problem was limited to establishing a magnitude scale for shallow earthquakes ($h \leq 50$ kilometers) with the epicentral distance greater than 19°. The scale is based on amplitudes of vertical-component surface waves with periods of about 20 seconds. The procedure used for establishing the method is described. The magnitude formula used is:

$$M = \text{Log } A_{20} + 1.25 \text{ Log } \Delta^{o} + R_{e} + 2.98$$

where A_{20} is the amplitude of ground motion expressed in microns (1 micron = .001 millimeter) of surface waves with about 20-second periods; Δ^{o} is the epicentral distance in degrees; R_e is a regional correction to be applied to correct for variation of energy in azimuth, wave path, etc. The magnitudes of 53 earthquakes were computed using the formula above. The resulting magnitudes agree with those published by the Pasadena Seismic Bulletin for corresponding earthquakes with a difference not greater than ± 1/2 magnitude unit for reliable data. Differences in magnitude showing regional trends were noted; a negative trend was noted in Eastern Asia, and a positive trend for the region south of South America.

CAHILL, J. P., H. P. GAUVIN, and J. C. JOHNSON, Effective Transmission of Thermal Radiation from Nuclear Detonations in Real Atmospheres, Rept. No. 62-456, AF Cambridge Res. Labs., Bedford, Mass., 1962.

VESIAC No. 1854

The objective of this report is to provide as simple a technique as practicable for the prediction (consistent with a moderate degree of confidence) of thermal inputs to targets from nuclear weapons. This technique is developed for use in the field with available meteorological data.

A study is made of the geographical factors influencing the transmission of thermal radiation from nuclear weapons through cloudless atmospheres. The results are presented as the ratio of the irradiance received on a $2\text{-}\pi$ detector in the presence of an attenuating atmosphere to the irradiance expected on the same detector in free space. The primary influencing factors considered are the scattering and absorbing properties of the atmosphere, reflection from the underlying surface, the temperature-time characteristics of the source, and the source-detector geometry.

The results are presented graphically, with contours of τ (effective transmission) for each atmospheric model studied. Ground-level visual ranges of 2, 10, and 50 nautical miles were incorporated into both wet and dry atmospheres, which in turn were terminated with a surface having albedos of either 0, 0.2, or 1.0.

The combination of parameters chosen to construct the atmospheric models from which τ was evaluated is typical of average conditions expected in the three principal regions of the earth: the tropics, the temperate zone, and the arctic region in both summer and winter.

CARD, D. C., Jr. See Rinehart, J. S.

CARDER, D. S, "Seismic Investigation of Large Explosions," J. Coast & Geod. Survey, 1948, No. 1, pp. 71-73.

VESIAC No. 885 The Army and Navy in 1945 and 1946 exploded large quantities of unserviceable ammunition near Arco, Idaho. This paper discusses the seismic aspects of certain of these explosions. For a 250,000-pound charge of TNT, it presents graphs showing the attenuation of displacement with distance, the attenuation of acceleration with distance, and the ratio of maximum acceleration to the weight of the explosive used. The paper discusses the equipment and procedure used, displacements and accelerations, travel-time data, and air waves.

CARPENTER, E. W. See Black, M. C.

CARRON, J. P., P. NOZIERER, and F. PERRIN, "Seismo-geology: Variations of Background Seismic Noise in the Parisian Basin," in Comptes rendus des séances de L'Académie des sciences, I, 248, Gauthier-Villars, Paris, France, 1959, pp. 3462-3464.

VESIAC No. 1656 VU Seismic background noise has been recorded at 18 stations in the Parisian basin for 1 cps and less. There is a clear correlation between the amplitude of the background noise and the depth of the sediment above the Permian layer.

CARTS, S. L., Jr., Soil Density Studies (Thermal), Tech. Summ. Rept. 1, U. S. Army Res. and Dev. Labs., Fort Belvoir, Va., 1961.

VESIAC No. 255 The objective of the overall inquiry of which this study is a part is to determine if density changes occurring in soils where underground nuclear explosions have taken place can be detected by measurements with nuclear instruments or thermal imaging techniques and used to differentiate blast areas from non-blast areas.

This report presents results of preliminary measurements made at the Orchid test site with thermal imaging equipment in June 1961. Satisfactory locations are named for observing the Orchid test area for purposes of thermal-imaging research, and the general test procedure used for the preliminary study, with only minor modification, is found to be suitable for future tests.

CHABAI, A. J., et al., Close-in Phenomena of Buried Explosions, Rept. No. SC-4711(RR) on Contract DASA-EO-300-60, Sandia Corp., Albuquerque, New Mex., 1961 (OFFICIAL USE ONLY).

VESIAC No. 1824 VU

CHAKRABARTY, S. K., and C. F. RICHTER, "The Walker Pass Earthquake and Structure of the Southern Sierra Nevada," Bull. Seis. Soc. Am., 1949, Vol. 39, No. 2, pp. 93-107.

VESIAC No. 297 The analysis of recorded arrival times of shock waves at various stations indicates that the principal earthquake in the Walker Pass region (Calif.) on 15 March 1946 was located at 35°43'.5 N, 118° 03'.3 W, at a depth of 22 km, with origin time at 05:49:35.9 PST. Epicenters of aftershocks scattered about this, with some indication of a NNE-SSW trend. The observed times fit a structure with layers 21.7 km, 9.7 km, and 10.7 km thick. Velocities of the longitudinal and transverse waves agree with those previously determined by Gutenberg for southern California. The effect of the "root" of the Sierra Nevada is seen in the failure of Pn to record at Tinemaha, although it appears there on the seismograms of shocks east and west of the principal group.

CHAO, E. C. T. See Shoemaker, E. M.

CHEKIN, B. S., "On a Spectrum of Waves, Reflected and Refracted by a Plate," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 11, pp. 738-742.

VESIAC No. 1305 Approximate formulas are derived which hold in the vicinity of a wave front and characterize the transformation of a spectrum of an incident longitudinal spherical wave reflected and refracted by a plate. It is assumed that only longitudinal waves are propagating in the medium.

CHEKIN, B. S., "Reflection and Refraction of Seismic Waves at a Weak Interface," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 1, pp. 9-13.

VESIAC No. 1319 The author examines, in the ray approximation, waves reflected and refracted in a non-homogeneous medium from an interface where the gradients of velocity and Lamé's constants are discontinuous. The coefficients of reflection and refraction are introduced.

CHEKIN, B. S., "Wave Form Changes on Reflection and Refraction," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 4, pp. 36-46.

VESIAC No. 1676 This paper reviews the change of wave form arising from total internal reflection at a plane boundary between two media or from waves passing through a stratum. Attention is given to media in which only longitudinal waves are propagated. The problem is considered for plane waves, and some new formulas are obtained both for waves of "smooth" character and also for waves expressing "concentrated" interactions.

CLABBURN, E. J., D. J. JAMES, and R. D. ROWE, Small Scale Experiments Using Distributed High Explosive Charges to Simulate the Pressure Wave Form on the Wall of a Cavity from the Decoupled Subterranean Detonation of a Nuclear Weapon, AWRE Rept. No. E2/60, 1961 (OFFICIAL USE ONLY).

VESIAC No. 986

CLAY, C. S., Methods for Geophysical Measurements Using Noise or an FM Source, Tech. Rept. No. 72, Columbia Univ., Hudson Labs., Dobbs Ferry, N. Y., 1959.

VESIAC No. 1161
AD 230 269

A method of making geophysical studies with a band-limited noise source or FM source is described. The travel times to subsurface reflectors are obtained by cross correlation of the received signal with that transmitted by the source. Travel times in the case of the FM source can be obtained by heterodyning the signal with the source and filtering the result.

A single sound source and receiving station are required for the studies. An estimate of the equipment that would be required to do reflection work in deep and shallow water is given.

COLLINS, T. K., Adiabatic Decomposition of Explosives, Tech. Rept. No. 48, Inst. Study Rate Processes, Univ. of Utah, Salt Lake City, Utah, 1955.

VESIAC No. 268
AD 87 615

This article describes investigations of the behavior of primary and sensitive secondary explosives under the condition of adiabatic decomposition. A method was found to separate the total time lag into the period before compression and the period after. Mean flame velocities showed that both primary and secondary explosives exhibit a burning phenomenon rather than detonation in the thin layers used in the drop test. The flame-velocity determinations substantiated the hot-spot theory of initiation by impact, and the measured time lags were found to be about the same for the primary and secondary explosives. The magnitude of the impact energy affected the time lag only slightly. The time lag results were analyzed in the light of absolute reaction rate theory, the temperatures of the initiation hot spots were calculated, and the resulting temperatures were found to be of the order of the melting point of the explosive in question.

COLLINS, T. K., R. R. DOELLE, and R. T. KEYES, Measurements of Air and Ground Shock Disturbances Arising From Demolition Activities at Seneca Ordnance Depot, Rept. No. 1, Inst. Stud. Rate Processes, Univ. of Utah, 1956.

VESIAC No. 252
AD 111 550

Because of complaints of damage to residential housing, the intensity of both ground shock waves and air pressure waves produced by conventional explosive charges ranging in size from 10 to 100 lbs were investigated. Ground shock waves were measured with geophones. The wave through subsurface shale was lower in frequency than the surface wave traveling through the overburden. The maximum displacement amplitude for the subsurface wave was 0.0000092 inch and for the surface wave, 0.000085 inch. Neither was considered damaging. Air pressure waves were recorded by microphone and reached a maximum of 2.60 lb/ft^2 at a distance of 3000 feet. These were also below the damaging level. Temperature inversions and wind-velocity gradients may focus sound waves to create areas of loud noise. The report includes recommendations for procedures that will produce minimum air-pressure effects.

CORBY, G. A., A Preliminary Study of Atmospheric Waves Using Radiosonde Data, Rept. No. M.R.P. 985, Meteorological Office Air Ministry Meteorological Res. Comm., London, 1956.

VESIAC No 1152
AD 139 535

This paper treats a trial determination and analysis of the vertical air currents revealed by six months' radiosonde data from four British upper-air stations. Examples of wave motions, distribution of maximum vertical currents, seasonal and synoptic variations, diurnal variations, wind speed and direction, wavelength, and apparent distortion of temperature structure are discussed. Most of the cases showed evidence, often striking, of vertical currents which were periodic along the path of the balloon. The paper concludes that where upper-air stations are to the lee of hills or mountains, the routine radiosonde data can provide a valuable means of studying orographic lee waves, and of building up background statistics of such phenomena.

COX, E. F., Microbarometric Waves From the Helgoland "Big Bang," Rept. No. 1070, Naval Ord. Lab., Washington, D. C., 1947.

VESIAC No. 696

Five thousand tons of high explosives detonated on Helgoland 18 April 1947, created air-pressure perturbations recorded at ten stations from 66 and 1000 km SSE from Helgoland. New microbarographs responding to frequencies of 0.05 to 5.0 cps were designed and constructed. Four meteorological stations obtained weather data up to an altitude of 29.5 km at blast time. With negligible winds at higher altitudes, interval velocities of abnormal microbarometric signals permit calculations of upper-atmosphere temperatures. Temperature rises steeply from 221°K at 32 km to 285°K at 42.5 km, then more slowly to 294°K at 55 km. The small gradient from 43 to 55 km gives a new explanation for observed outer boundaries of abnormal signal zones, a thesis substantiated by evidence of dispersion. Very-long-period (about 10 seconds) waves recorded beyond 400 km are believed to have returned from the second high-temperature region of the upper atmosphere. Arrival times are best matched by assuming a temperature valley between 55 and 86 km, with bottom temperature 170°K extending from 64 to 79 km. A steep rise to 296°K at 86 km precedes a more gradual rise to 399°K at 172 km. Calculated values above 100 km are dubious.

CRABTREE, E. H. See Rinehart, J. S.

CROMIE, W. J., "Preliminary Results of Investigations on Arctic Drift Station Charlie," in Geology of the Arctic, Univ. of Toronto, Toronto, Ont., 1961, pp. 690-707.

VESIAC No. 1057
AD 252 176

Station Charlie, established on the pack ice of the Arctic Basin, drifted in an east-west line across a shallow peninsula of the Chukchi shelf during July and August 1959. Continuous soundings were taken within an accuracy of one meter across the feature and in adjacent deep water. A bathymetric profile has been constructed and the angles of slope computed from seismic reflections.

In addition to investigations in submarine geology and biology, work in seismology and magnetics was performed. Reflection tech-

niques were used for determinations of dip and strike of bottom sediments. Studies were made of long-range sound transmission by seismic means. Both relative and continuous absolute values of the magnetic field were measured. Records were taken during a magnetic storm and solar flare disturbance.

A vertical seismometer was installed on the pack ice and successfully recorded at least one earthquake. Small variations in atmospheric pressure were recorded continuously on a microvariobarograph.

CUTRONA, L. J., E. N. LEITH, and L. J. PORCELLO, "Filtering Operations Using Coherent Optics," Proc. Nat. Electron. Conf., 1959, Vol. 15.

VESIAC No. 1080 Coherent optical systems inherently possess a Fourier transform relation between the light amplitude distributions at the front and back focal planes of the lens used in such systems.

An optical system which alternately presents space-domain functions and successive Fourier transforms is easily implemented. As a result, operations of an integral transform nature are carried out often more conveniently than if using an electronic channel. Illustrative examples are presented, along with the results of some experiments of interest to the communications engineer. Throughout the treatment, the two-dimensional nature of an optical channel is exploited in such a manner as to provide either a true two-dimensional processor or a multi-channel filter bank.

CUTRONA, L. J., E. N. LEITH, C. J. PALERMO, and L. J. PORCELLO, "Optical Data Processing and Filtering Systems," IRE Trans. Prof. Group Info. Theory, 1960, Vol. IT-6, No. 3, pp. 386-400.

VESIAC No. 1078 Optical systems, which inherently possess two degrees of freedom rather than the single degree of freedom available in a single electronic channel, appear to offer some advantages over their electronic counterparts for certain applications. Coherent optical systems have many successive (and easily obtainable) two-dimensional Fourier transforms of any given light amplitude distribution, or (if one uses astigmatic optics) one-dimensional transforms. Therefore, most linear operations of an integral transform nature are easily implemented. The optical implementation of integral transforms which are of importance to communication theory is discussed; the general problems of optical-filter synthesis and multichannel computation and data processing are introduced. A discussion of potential applications follows. Astigmatic systems, which permit multichannel operation in lieu of two-dimensional processing, are treated as a special case of general two-dimensional processors. Complex input functions are discussed with relation to their role in coherent optical systems.

DANA, S. W., "The Amplitudes of Seismic Waves Reflected and Refracted at the Earth's Core," Bull. Seis. Soc. Am., 1945, Vol. 35, No. 1, pp. 27-35.

VESIAC No. 300 Assuming a zero focal depth for the source of seismic waves, a negligible effect of discontinuities between the core and the earth's

surface, and no discontinuities in the core, the author calculates the amplitudes of horizontal and vertical displacements of the surface caused by various waves reflected and refracted at the earth's core at various angular distances from the source to the point of emergence. The periods of the waves are assumed to be the same and differences in absorption are neglected. The results of the calculations are tabulated.

DANA, S. W., "The Partition of Energy Among Seismic Waves Reflected and Refracted at the Earth's Core," Bull. Seis. Soc. Am., 1944, Vol. 34, No. 4, pp. 189-197.

VESIAC No. 299 Assuming that the core of the earth, though not necessarily liquid, resembles a fluid in that it does not transmit transverse waves, the author calculates the relative energies of four different waves at various angles of incidence: (1) an incident P wave in the mantle against the core, in which case the results agree with the calculations of Knott; (2) an incident P wave in core against the mantle, in which case, when the angle of the incident P wave equals 35° 44', the square root of the relative energies of the refracted P and S waves equals 0 and the reflected P waves equal 1.0; (3) an incident SV wave in the mantle against the core, in which case, when the angle of the incident S wave equals 31° 57' 06", the square roots of the relative energies of both the reflected and refracted P waves equal 0 and the reflected SV wave equals 1.0, and further, when the angle of the incident SV wave equals 64° 59' 30", the square root of the relative energy of the refracted P wave equals 0 to 90° and the reflected SV wave equals 1.0 to 90°; (4) an incident SH wave in the mantle against the core, in which case all of the energy goes into the reflected SH wave regardless of the angle of incidence.

DARBYSHIRE, J., "Identification of Microseismic Activity with Sea Waves," Proc. Roy. Soc. London Ser. A, 1950, Vol. 202, pp. 439-448.

VESIAC No. 1225 Three series of simultaneous wave and microseism records are examined. They give a clear indication that bands of microseismic waves from different sources can be distinguished by submitting seismograph records to frequency analysis. The agreement between the results of analysis and the theoretical expectation from the prevailing meteorological conditions appears to justify the assumption that microseismic waves of different periods travel independently. Under the simple meteorological conditions that have been studied, each band of microseismic activity can be identified with a band of sea waves twice its period. The existence of this two-to-one ratio between the period of waves and microseisms affords some confirmation of the theory that microseisms are produced in a region of interference between similar trains travelling in opposite directions, either near the coast or in deep water.

DAVYDOVA, N. I., "The Dependence of the Dynamic Characteristics of Longitudinal Head Waves Relating to Thin Layers on the Velocity Differen-

tiation of the Media," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 10, pp. 684-688.

VESIAC No. 1302 The writer draws conclusions about the dependence of the dynamic characteristics of longitudinal head waves relating to thin layers on the velocity ratios in the layer and in the surrounding medium. These findings are based on an analysis of the formulas put forward in an investigation by G. A. Gamburtsev and on theoretically calculated seismograms.

DAVYDOVA, N. I., "On the Dependence of the Amplitude of Longitudinal Head Waves, Associated with Thin Layers, from the Velocity Contrast of the Media," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 5, pp. 462-468.

VESIAC No. 1365 The results of experimental studies of the function $A(\delta)$ (i.e., the amplitude A as a function of the velocity contrast of the media δ) are presented for head waves associated with solid thin layers occurring in water. The experimental results are compared with the theory formulated by Gamburtsev for waves analogous to seismic head waves associated with thin layers; and compared also with the theoretical data on the function $A(\delta)$ for the case of head waves associated with the boundaries of half spaces.

DENNISON, A. T. See Roberts, F. A.

DENOYER, J., D. E. WILLIS, and J. T. WILSON, "Observed Asymmetry of Amplitudes from a High Explosive Source," Bull. Seis. Soc. Am., 1962, Vol. 52, No. 1, pp. 133-137.

VESIAC No. 897 Frequency analysis of seismic magnetic-tape records from a 500-ton high-explosive source shows a pronounced variation of amplitude with frequency for two different azimuths from the source. This amplitude variation is attributed, at least in part, to diffraction effects produced by the geologic structure in the vicinity of the source. There is a possibility of generating both SV and SH waves from P waves within this structure.

DIANOV-KLOKOV, V. I., "An Apparatus for Measuring Small Remanent Magnetization of Rocks," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 91-95.

VESIAC No. 1467 An apparatus for measuring small remanent magnetization of rocks is described; it uses the "rock generator" principle. For cubic samples with dimensions 24 × 24 mm and a time constant of $\tau \cong 1$ second, the sensitivity of the apparatus amounts to $I_{min} = 5 \times 10^{-8}$ gauss (s/n = 1). The sample holding chuck which has a light mass introduces small systematic perturbations which can be circumvented without any special arrangement to compensate for them. The possibility of constructing a pulse-type "rock generator" of higher sensitivity is also considered.

DOELLE, R. R. See Collins, T. K.

DOLBILKINA, N. A. See Monakhov, F. I.

DONN, W. L., and M. EWING, "Atmospheric Waves from Nuclear Explosions, Part I," J. Geophys. Res., 1962, Vol. 67, No. 5, pp. 1855-1866.

VESIAC No. 1915 This paper describes records of acoustic-gravity waves generated by multimegaton nuclear explosions which occurred between 1952 and 1961. Atmospheric pressures recorded by sensitive instruments widely distributed over the earth are the basis of the analysis. The records begin with a dispersive wave train in which period decreases from a maximum of about 9 minutes to a minimum of 0.5 minute. Short-period waves which appear in the latter parts of the records, and which often overlap the dispersive train, are explained as belonging to higher modes. The method initiated by seismologists in the study of earthquake surface waves is used to compute group-velocity dispersion curves for the dispersive wave trains. These curves are compared with preliminary theoretical models for different thermal structures of the atmosphere. The empirical dispersion curves indicate that the atmospheric structure controlling the dispersion of these waves varies significantly along different profiles and probably along different segments of the same profile. The curves which best approach world-wide average atmospheric conditions seem to be those corresponding to meridional paths or those whose paths cause cancellation of the varying zonal winds.

DONN, W. L. See Ewing, M.

DORMAN, J., "Period Equation for Waves of Rayleigh Type on a Layered, Liquid-Solid Half Space," Contr. No. AF 19(604)-8375, Bull. Seis. Soc. Am., 1962, Vol. 52, No. 2, pp. 389-397.

VESIAC No. 1867 VU A convenient formulation of the boundary conditions applicable to elastic wave propagation in a layered, solid half space was obtained by Haskell in terms of matrix algebraic operations. Developing this method further, the author solves the analogous problem for liquid layers and defines the treatment of liquid-solid interfaces in matrix notation. This leads to a simple expression for the period equation for surface waves of the Rayleigh type on a half space of solid and liquid layers arbitrarily interspersed. This formulation of the period equation appears to yield the most rapid method for numerical computations on surface wave dispersion. The period equation is the basis for computations used in several recent studies of earthquake surface-wave dispersion.

DORMAN, J., M. EWING, and J. OLIVER, "Study of Shear-Velocity Distribution in the Upper Mantle by Mantle Rayleigh Waves," Bull. Seis. Soc. Am., 1960, Vol. 50, No. 1, pp. 87-115.

VESIAC No. 1918 Comparison of Rayleigh-wave dispersion computations on 11 models of shear-velocity structure of the continental and oceanic crust-mantle systems permits a detailed explanation of observed mantle Rayleigh-wave dispersion for periods less than 250 seconds.

Shear-wave data for oceanic areas are meager, but from Rayleigh-wave dispersions, there is firm evidence that the shear velocity immediately below the Mohorovicic discontinuity of deep ocean basins is about 4.6 to 4.7 km/sec, about the same as under the continental Mohorovicic discontinuity.

Relatively rapid downward increase of shear velocity between depths of about 400 to 500 km is the chief cause of the observed minimum group velocity at a period of about 225 seconds. Curvature of the earth is probably the cause of systematic differences beyond periods of 200 to 250 seconds between observed group velocities and group velocities computed according to the flatearth hypothesis.

DORMAN, J. See Bolt, B. A.; Oliver, J.

DORMAN, W. J. and J. A. BROWN, Meteorological Focusing of Sound and Blast Waves and its Prediction by Analogue Techniques, Rept. No. 1014, Ball. Res. Lab., Aberdeen Proving Ground, Md., 1957.

VESIAC No. 999
AD 139 250

Meteorological focusing can cause sound and blast waves resulting from the testing of large guns and explosives to be propagated at high amplitude over unusually large distances. Thus damage or other undesirable effects are obtained at locations normally thought to be at a safe distance from the testing site. Possible damage can be avoided by the cancellation of scheduled tests on days when the existing meteorological conditions are likely to produce focusing of the resulting blast waves.

In this report the equations of the trajectory of a point in a blast wavefront are derived for the general case and modified for several special cases. A method is given for predicting meteorological focusing by means of an analogue-computer solution of these equations with data obtained from soundings of the lower atmosphere. The basic requirements of a computer to be used for this purpose are outlined. The schematic diagram of a particular type of computer suitable for this application, with an itemized estimate of its cost, is included. The recommended use of the computer, the form of its required inputs, and the presentation and interpretation of its output are also discussed.

DOWNING, A. C., "The Construction of Micro-Galvanometer Systems," J. Sci. Instr., 1948, Vol. 25, pp. 230-231.

VESIAC No. 1833

This report describes the construction of micro-galvanometer systems having a short period (0.01), low resistance (20 Ω), a width of 0.3 to 0.5 mm, and a weight of 3-5 mg. Methods of winding and inserting connecting tags in the form of a loop and of removing surplus insulation to reduce the inertia of the coil are given. A static balance of the system is undertaken by bending the tags and adding small weights to the coil. These weights are placed close to the axis in order to obtain good dynamic results.

DURELLI, A. J. See Riley, W. F.

DUVALL, W. I., and T. C. ATCHISON, Rock Breakage by Explosives, Rept. of Investigations 5356, U. S. Bureau of Mines, U. S. Dept. of Interior, 1957.

VESIAC No. 983 This report presents experimental data on crater formation in four rock types. From an analysis of these data, a general theory of rock breakage by explosives is deduced. This theory accounts for most of the rock breakage and other phenomena that occur when a concentrated charge is detonated in a drill hole near a free surface. From instrumented crater tests and high-speed motion pictures of the explosion, various experimental checks on the deduced theory of rock breakage are made.

D'YAKONOV, B. P., "The Diffraction of Electromagnetic Waves by a Sphere Located in a Half-Space," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1120-1125.

VESIAC No. 1432 This paper solves the problem of the diffraction of electromagnetic waves at a sphere of arbitrary conductance which is located in a conducting half-space with a plane boundary. The solution is obtained in a form that is applicable to calculations that are relevant to the low-frequency method of electric geophysical exploration.

EATON, J. P., "Theory of the Electromagnetic Seismograph," Bull. Seis. Soc. Am., 1957, Vol. 47, No. 1, pp. 37-76.

VESIAC No. 1786 Although the development of the first moving-coil electromagnetic seismograph and a primitive theory to account for its behavior date back almost fifty years, the responses of only a few simple types of these instruments have had adequate theoretical treatment. This lack of theory restricted, but did not stop, the development of other designs for which no adequate theory existed. Confusion and controversy have arisen over the behavior of these later designs. Some work has been done on obtaining magnification curves for these instruments directly by the use of shaking tables or other artificial driving devices. On the whole, however, instruments of this type now in use simply are not calibrated.

An attempt guided by the work of previous investigators has been made to clarify further the behavior of electromagnetic seismographs by extending the theoretical treatment. Three new types of seismographs (more properly "adjustments" of seismographs), each of which includes the classical Galitzin as a limiting case, are proposed. Methods for adjusting and calibrating these instruments are outlined.

Since overcritical damping is used in two of the adjustments proposed, a method is given for determining the damping constant of an overdamped galvanometer or seismometer.

EGGLETON, R. E. See Shoemaker, E. M.

EMURA, K. See Honda, H.

ENESCU, D., "Energy Radiated from Earthquake Foci in Seismic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 10, pp. 961-962.

VESIAC No. 1609 Equations for the energy flux in longitudinal and transverse waves are derived for the case of a source represented by a limited area of faulting where the displacements are given by a vector of Burgers.

EPINAT'EVA, A. M., "Interfering Multiple-Reflected Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 8, pp. 779-787.

VESIAC No. 1393 This paper discusses the problems of a number of longitudinal multiple waves which develop in some types of horizontally layered media and of the amplitudes of the interfering multiple-reflected waves. The comparison of amplitudes of the multiple-reflected and primary waves for certain types of media shows that starting with a certain time, the interfering multiple waves can be more intensive than once-reflected waves and will lead to the predominance of the multiple waves on the record. This discussion is conducted for normal-incidence waves.

EPINAT'EVA, A. M., "Reflected Waves Produced at Angles of Incidence Greater than Critical," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 6, pp. 16-40.

VESIAC No. 1686 It is shown in the experimental material that in some real media, intense reflected longitudinal waves are produced when waves fall on a reflecting boundary at angles of incidence greater than critical. The intensity of these waves beyond the source of refracted waves exceeds the intensity of the refracted waves corresponding to the same dividing boundary. The experimental results are compared with theoretical calculations.

EPINAT'EVA, A. M., and L. A. IVANOVA, "High-Frequency Filtering as a Means of Eliminating Multiple Reflections," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 3, pp. 244-252.

VESIAC No. 1341 The authors show that certain types of multiple reflections can be eliminated by means of high-frequency filtering; this filtering provides a better and more detailed study of the profile than the commonly used medium-frequency seismic apparatus.

EPINAT'EVA, A. M., and N. G. MIKHAILOVA, "The Determination of Types of Reflected Multiple Waves by their Kinematic and Dynamic Characteristics," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 7, pp. 685-695.

VESIAC No. 1384 This paper presents the experimental data on the kinematic characteristics of multiple-reflected waves recorded with a medium-frequency ($f = 37$ cps) and high-frequency ($f = 105$ cps) instruments. These instruments were used to determine types of multiple waves. By using the wave amplitude, one can define more accurately the wave propagation with multiple reflections.

ERGIN, K., "Energy Ratios of the Seismic Waves Reflected and Refracted at a Rock-Water Boundary," Bull. Seis. Soc. Am., 1952, Vol. 42, No. 4, pp. 349-371.

VESIAC No. 309 The energy ratios of P and S waves incident at both sides of the ocean floor for various velocity and density ratios are computed. General behavior, zeroes, and extreme points are tabulated and plotted. At critical angles of incidence, the whole energy goes into the reflected wave of the same kind as the incident wave. On either side of these critical angles peculiar behaviors are observed.

ERICSON, D. B., "Pleistocene Climatic Record in Some Deep-Sea Sediment Cores," Ann. N. Y. Acad. Sci., 1961, Vol. 95, pp. 537-541.

VESIAC No. 1051 Cores raised from the North Atlantic and adjacent seas indicate differences in sediment accumulation over time and imply differences in sea level or rate of precipitation. Climatic conditions may be inferred from the relative abundance of certain species of planktonic foraminifera in each sedimentary layer. Slumping, the erosion of sediment layers, or the rapid deposition of sediment by turbidity currents may disturb the record. However, layer-by-layer correlation between two or more cores from a particular region may cancel out differences between individual cores and allow a continuous record to be constructed. Six alternating faunal zones, distinguished by the dominance of high- or log-latitude species of planktonic foraminifera, have been established and traced southward from the Canary Islands, across the equatorial Atlantic, through the Caribbean, and into the western Atlantic. Radiocarbon dating has established the date of change between two of the zones at 11,000 years ago. Different interpretations of the correlations of these zones with glacial periods are discussed. The author believes the chronology of Pleistocene climatic events is not yet certain.

ESPINOS, A. F., G. H. SUTTON, and H. J. MILLER, (S.J.), "Pulse Technique of Instrument Calibration," Earthquake Notes, 1961, Vol. 32, p. 22.

VESIAC No. 1795 A pulse technique for seismograph calibration was developed and then tested by a variety of methods. In the application of this technique, a known transient in the form of an electrical signal is injected through either a Willmore-type calibrating bridge or an independent coil, into the seismometer; then the corresponding output transient of the system is recorded. Comparison of the Fourier transform of this transient with that of the input pulse yields phase and relative amplitude response of the seismograph as a function of the period. Absolute amplitude response may be calculated if two, easily determined, constants of the seismometer are known. This technique makes practical the daily calibration of seismographs without disturbing the instrument for more than a very few minutes.

The technique was tested by comparison of various transient and steady-state results using both digital and analog techniques. A variety of output transients corresponding to various response curves have been calculated for a standard input transient. By comparison of these

transients with experimental results, it is possible to obtain the response of the instrument with reasonable precision without computation.

EWING, J. I., and G. B. TIREY, "Seismic Profiler," J. Geophys. Res., 1961, Vol. 66, No. 9, pp. 2917-2927.

VESIAC No. 1055 Equipment for recording and profiling seismic refraction, seismic reflection, and underwater-sound-transmission data has been developed at Lamont Geological Observatory. The detector is a piezoelectric crystal hydrophone, the amplifiers are transistorized, modeled after those normally used in seismic refraction work, and the recorder is a modified Times Facsimile drum recorder. Profiling is achieved by initiating the drum rotation with the shot-instant signal. Refraction data are displayed in the form of a standard time-distance plot: the distance scale is determined by the speed of the shooting ship; and the time scale by the speed of rotation of the drum, which can be preset by proper choice of gears and electrical switching. Reflection data are recorded in section form, analogous to standard echo-sounder records. A choice of full-wave or half-wave rectification is available, and logarithmic or linear amplifier response can be selected as desired.

EWING, M., and W. L. DONN, "Pleistocene Climate Changes," in Geology of the Arctic, Univ. Toronto Press, Toronto, Ont., 1961, pp. 931-941.

VESIAC No. 1044 It is postulated that the ice-free condition of the Arctic Ocean is the direct cause of Pleistocene ice ages in the northern hemisphere. Evidence indicating an open Arctic Ocean is found from a study of thermal gradients, post glacial uplifts, Arctic seismicity, and the heat budget of the Arctic area. An attempt is made to explain the Pleistocene climate changes in terms of the alternations of ice-free with ice-covered states of the Arctic Ocean.

EWING, M. and B. C. HEEZEN, "Puerto Rico Trench Topographic and Geophysical Data," in Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., 1955, pp. 255-268.

VESIAC No. 1042 This report summarizes data on topography, earthquake seismology, gravity, magnetism, sediments, and seismic refractions for the Puerto Rico Trench. The data indicate that turbidity currents have deposited a column of sediments, that the Cayman Trench has an origin and structure similar to the Puerto Rico Trench, and that the crust has been thinned beneath the trenches. A possible explanation of these observations is the formation of a fissure by tension, and subsequent elevation of its floor by subcrustal flow.

EWING, M., S. MUELLER, M. LANDISMAN, and Y. SATO, "Dispersive Transients in Earthquake Signals," Proc. 3rd Internat'l Cong. on Acoustics, Elsevier Pub. Co., Amsterdam, Holland, 1961, pp. 426-428.

VESIAC No. 1046 This paper reports the application of an electronic sound spectrograph to the analysis of transients in complicated earthquake signals. With this spectrograph, wave trains of greater complexity than those

which have been treated by Fourier analysis or the peak-and-trough method can be analyzed. This spectograph can take an electrical transient of 20 seconds' duration and give the relative intensity as a function of time for all spectral components from 5 to 500 cps. A tape recording of the short-period vertical at Pasadena was played back with a speed increase of about 600 for a number of earthquakes; this allowed the analysis of over 3 hours of earthquake recording in the period range from 1 to 125 seconds. A complete analysis may be done in 5 minutes after transferring the signal to the analyzer; a procedure which permits the study of the entire seismic train, including both body waves and surface waves. Good results and fundamental limitations of the method are discussed (e.g., the method resolves complex composite transient signals and allows interpretation of inherent detail; the method's limitations involve reciprocal spreading and the ring time of the filter). The device can analyze signals whose total time durations range from 0.8 to 20 seconds, and whose spectra extend from 0 to 13,350 cps, with a lower frequency limit near 5 cps.

EWING, M., S. MUELLER, M. LANDISMAN, and Y. SATO, "Transient Phenomena in Explosive Sound," Proc. 3rd Internat'l Cong. on Acoustics, Elsevier Pub. Co., Amsterdam, Holland, pp. 274-276, 1961.

VESIAC No. 1045 A sound spectrograph was used to study the complex dispersion in explosive sounds. Tape recordings of two shots were analyzed. A 25-lb charge fired in 30 meters of water, and recorded at a range of 9.7 km, sent out, in addition to other signals, a water wave which reached the receiver 6.38 seconds after the explosion time. Study indicates that the maximum of energy in this case does not arrive with the Airy phase, but instead arrives at frequencies somewhat displaced from the group-velocity extrema of the various modes. A 3-lb charge fired in 30 meters of water, and recorded at a range of 5.2 km, resulted in a water-wave travel time of 3.40 seconds. These two shots show, among other things, that the higher modes are more strongly attenuated with increasing distance.

EWING, M., and F. PRESS, Crustal Structure and Surface-Wave Dispersion, Part II: Solomon Islands Earthquake of July 29, 1950, Tech. Rept. No. 16, Lamot Geol. Obs., Palisades, N. Y., 1951.

VESIAC No. 1177
AD 4 585

This paper analyzes Rayleigh waves from the Solomon Islands earthquake (29 July 1950), recorded at Honolulu, Berkeley, Tucson, and Palisades. Both the direct waves and those propagated through the Antipodes were observed for all stations except Honolulu. Application of a correction for land travel results in a dispersion curve for the oceanic portion of the path. It is found that the observed dispersion could be accounted for by propagation through a layer of water 5.57 km thick overlying simatic rocks having a shear velocity of 4.56 km/sec and a density of 3.0 gm/cc. Basement structure in the Pacific, Indian, South Atlantic and North Atlantic Oceans is identical within the limits of accuracy of the method.

The sinusoidal nature and duration of the code is explained by the effect of the oceans on the propagation of Rayleigh waves.

The results are compatible with seismic-refraction measurements in the Atlantic and Pacific Oceans.

EWING, M., and F. PRESS, "Geophysical Contrasts Between Continents and Ocean Basins," in Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., 1955, pp. 1-6.

VESIAC No. 1033 Geophysical contrasts between continents and oceans are described and discussed. Seismic-refraction measurements have established beyond doubt that the silicic crust under ocean basins is no more than one fifth as thick as that under continents, and corresponds in composition to the more mafic parts of the continental crust. This crustal structure, revealed by seismic measurements, confirms the isostatic equilibrium (determined by gravity measurements) between continents and ocean basins. Remarkable uniformity of crustal structure within continents or within ocean basins is revealed when obviously anomalous areas such as margins, mountains, and trenches are omitted. Magnetic measurements are meager, but those available indicate that over certain large oceanic areas, the magnetic field is unusually smooth.

The borderland between continents and ocean basins represents one of the most difficult areas for geophysical investigation but is crucial in most studies. Existing data reveal a tendency for abnormally low seismic velocities in the oceanic crust near continental margins.

EWING, M., and F. PRESS, Mantle Rayleigh Waves from the Kamchatka Earthquake of November 4, 1952, Tech. Rept. No. 25, Lamont Geol. Obs., Palisades, N. Y., 1953.

VESIAC No. 1176
AD 1 906

This paper analyzes mantle Rayleigh waves from the Kamchatka earthquake (4 November 1952). The new Palisades long-period vertical seismograph recorded waves of orders R6-R15, the corresponding paths involving up to 7 complete passages around the earth. The dispersion data for periods below 400 seconds are in excellent agreement with earlier results, and can be explained in terms of the known increase of shear velocity with depth in the mantle. Data for periods of 400-480 seconds indicate a tendency for the group-velocity curve to level off, suggesting that these long waves are influenced by a low or vanishing shear velocity in the core. Adsorption studies indicate a value $1/Q = 370 \times 10^{-5}$ for the internal friction in the mantle at periods 250-350 seconds. This value is a little over half that reported earlier for periods of 140-215 seconds.

EWING, M., and J. L. WORZEL, "Long-Range Sound Transmission," in Propagation of Sound in the Ocean, Geol. Soc. Am., New York, N. Y., 1948.

VESIAC No. 1032 The authors describe experiments demonstrating a new method (using the natural sound channel) of sonic signalling at extremely long ranges in the oceans. Signals were made by exploding a 4-lb charge of TNT at a depth of about 4000 feet.

Such signals have extremely long-range transmission characteristics (probably 10,000 miles) and are positively identifiable. The abrupt termination of the signal permits arrival-time readings accurate to less than 0.05 second; if three suitably located stations receive the signal, the source may be located within a mile. The signal-duration-to-distance relationship permits distance estimation to 30 miles in 1000 on the basis of single station reception.

Limitations of these signals include the necessity for an unbroken deep-water channel (1000 fathoms) along the great circle path from source to receiver, and the time interval handicap imposed by the speed of sound through water (1 mi/sec).

Two receiving arrangements have been used, a hydrophone hung 4000 feet deep over the side of a stationary ship, and a shore-connected hydrophone lying on bottom 4000 feet deep.

An experimental network of listening stations is being installed by the Navy Department in the western Pacific, and this system of signalling has been given the name SOFAR.

Three applications of SOFAR to geological problems have been proposed: position fixing; discovery of shoal areas; and submarine volcano location.

EWING, M., J. L. WORZEL, N. C. STEENLAND, and F. PRESS, "Geophysical Investigations in the Emerged and Submerged Atlantic Coastal Plain, Part V," Bull. Geol. Soc. Am., 1950, Vol. 61, pp. 877-892.

VESIAC No. 903

Seismic-refraction measurements from the coast line to the edge of the continental shelf were made along three lines of traverse: near Cape May, N. J.; New York, N. Y.; and Woods Hole, Mass., respectively. An unconsolidated layer with velocity about 5800 ft/sec, a semiconsolidated layer with velocity about 11,500 ft/sec, and a layer, considered to be the basement, with velocity about 18,000 ft/sec were traced across each traverse.

On the Cape May traverse, the thickness of the sedimentary column runs from about 5000 feet near the beach to about 16,000 feet near the edge of the shelf. These measurements generally agree with the findings on the Cape Henry traverse in 1935. The well on Cape Hatteras, which recently reached basement at 9878 feet, confirms the seismic results. The cross-sectional area of the sedimentary prism off Woods Hole is smaller than that off New York, which in turn is smaller than that off Cape May. Depth to basement increases abruptly near the beach at Cape May, and about 30 miles off shore at New York. The basement starts to slope gently upward at, or just before, the edge of the continental shelf on these two profiles.

EWING, M. See Alsop, L. E.; Benioff, H.; Brune, J. N.; Donn, W. L.; Dorman, J.; Heezen, B. C.; Officer, C. B.; Oliver, H. W.; Oliver, J.; Press, F.: Worzel, J. L.

FEDOTOV, S. A., "Dynamic Characteristics of Reflected Waves Whose Arrival Times Are Not True Minima," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 5, pp. 30-41.

VESIAC No. 1682 Seismic waves which, after reflection from a curvilinear boundary, pass through a focusing zone, are propagated along a path for which the time limit is a maximum or a minimax. Seismic modelling data are given which show that for this type of wave, the relative intensity of subsequent phases increases, and that the dynamic hodographs of these waves can be approximately calculated by the "ray" method.

FEDOTOV, S. A., et al., "Some Results of a Detailed Study of the Seismicity of the South Kuril Islands," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 5, pp. 413-420.

VESIAC No. 1563 The paper gives the preliminary results of a study of the cross section of the absorption rate of seismic wave energy in the earth's crust and the upper part of the mantle in the South Kuril Island zone.

FILIPPOV, A. F., "Approximate Calculation of Reflected and Refracted Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 7, pp. 1-16.

VESIAC No. 1690 An account is given of a method for calculating waves reflected and refracted at a plane or curved boundary of two media. The method is only applicable for a near-the-front zone of the wave.

FLAMMER, C., J. HERNDON, and M. STALLYBRASS, Forced Oscillations of an Elastic Half-Space (Final Report), SRI Proj. No. PU-3061, Stanford Res. Inst., Menlo Park, Calif., 1961.

VESIAC No. 1781 A series solution is obtained for the stress and deformation field generated in a homogeneous, isotropic, elastic half-space by means of a rigid disc attached to the surface and oscillating normal to it. This mixed boundary value problem is resolved by introducing a system of oblate spheroidal co-ordinates and a pair of displacement potentials. The solution is exact to the extent that the amplitude factors in the series of spheroidal wave functions are determined by an infinite set of linear equations with complex coefficients.

FOMENKO, K. E. See Godin, YA. N.

FORBES, C. B., R. A. PETERSON, and V. R. MC LAMORE, VELA UNIFORM, Operation Dribble, On-Site Cavity Location, Seismic Profiling, Tatum Salt Dome, Lamar County, Miss., Contract AF 33(600)42384, United ElectroDynamics, Inc., Pasadena, Calif., 1961.

VESIAC No. 1158 VU An experimental seismic study was conducted at Tatum Salt Dome. This was the preliminary phase of an on-site inspection technique and was done prior to the construction of cavities in the salt dome. With a

special technique for reflection seismic profiling, two lines of control were shot across the proposed cavity sites, with one of the lines extending well beyond the limits of the salt. This technique, referred to as seismic focusing profiling (SFP), was developed to optimize the S/N by means of horizontal stacking of seismic energy from common depth points.

FORTSON, E. P., Jr., and F. R. BROWN, Effects of Stemming on Underground Explosions, Rept. No. AFSWP-823, Waterways Experiment Station, Vicksburg, Miss., 1957.

VESIAC No. 1138
AD 121 974

Research was carried out on the effects of stemming on underground explosions to determine the cratering capabilities of charges buried under varying amounts and types of stemming material. The experimental program was accomplished by the Waterways Experiment Station to furnish measurements of cratering, air blast, and other related data in order to form the basis for further study of the problem by the Engineer Research and Development Laboratories.

Specifically, 27-lb charges of C-4 and 54-lb dynamite charges were buried 3 feet below the surface in a homogeneous clay test pad constructed to rigidly controlled density. The charges were each tested under four conditions: unstemmed, one third, two thirds, and fully stemmed using the excavated clay as the stemming material. The C-4 charge was also tested with the hole one third stemmed with water. Test data consisted of measurements of crater and air blast; records of time of venting, time of initial ground rise, and seismic velocities; and time histories of earth-column growth.

Results of these rather limited tests showed that stemmed charges produce larger craters than unstemmed charges, and that one third stemmed charges produce true craters of approximately the same size and shape as fully stemmed charges. Water-stemmed charges produced crater dimensions which did not differ significantly from those produced by clay-stemmed charges.

FORWARD, R. L., D. ZIPOY, and J. WEBER, "Upper Limit for Interstellar Millicycle Gravitational Radiation," Nature, 1961, Vol. 189, No. 4763, p. 473.

VESIAC No. 315

Measurements taken on the Isabella (Calif.) strain gauge after an earthquake permitted identification of the earth's vibrational modes and a determination of their breadth and frequency. Data taken during quiet periods do not show peaks at frequencies of these vibrational modes. This extraneous strain noise above the level of actual strains in modes during quiet periods was utilized in computing the approximate upper limit of the effects of incident gravitational radiation. The results are tabulated and indicate that the Riemann tensor power spectrum cannot be larger than $\approx 10^{-75}/\text{cm}^4(\text{rad/sec})$ in the vicinity of 1 c/hr.

FRANCIS, B. A. See Fain, C. G.

FRANTTI, G. E., Auditory Recognition of Seismic Disturbances, Rept. No. 4595-2-P on Contr. No. AF 49(638)-1079, Inst. Sci. Tech., The Univ. of Mich., Ann Arbor, Mich., 1961.

VESIAC No. 892 VU The purpose of this project was to study the ability of the human ear to identify seismic signals generated by explosions and earthquakes. A successful auditory system would serve as a means of making rapid preliminary inspection of seismic recordings of unknown sources.

The author notes progress in instrumentation and field recording during the period under study. Equipment for analyzing recordings was being constructed, and was expected to be functioning by the end of January 1962. So far the Acoustics and Seismics Laboratory has collected some 280 recordings of earthquakes and chemical and nuclear explosions from which to choose sets for listening tests. More recordings of explosions in earthquake areas are needed for comparisons at short travel distances.

FRANTTI, G. E., D. E. WILLIS, and J. T. WILSON, "The Spectrum of Seismic Noise," Bull. Seis. Soc. Am., 1962, Vol. 52, No. 1, pp. 113-121.

VESIAC No. 900 The seismic-noise spectrum in the frequency range 0.5 to 31.5 cps is presented graphically for a number of sites over a wide geographical range. Except for a small anomalous effect near 2 or 3 cps, the curves of ground particle motion decrease smoothly with increasing frequency at a rate approximately proportional to the second power of frequency. The curves steepen at frequencies below 1 cps.

FRIEDMAN, M. P., "A Simplified Analysis of Spherical and Cylindrical Blast Waves," J. Fluid Mech., 1961, Vol. 11, Pt. 1, pp. 1-15.

VESIAC No. 893 Investigations into the behaviour of the gas flow behind spherical or cylindrical blasts have shown that secondary shocks arise within the original detonation gases. The secondary shock, at first weak, is carried outward with the expanding gases. Subsequently it strengthens and bends back toward the origin, arriving there with high intensity.

By using some recently developed techniques in shock dynamics and extending them where necessary, a theory is developed by which the motion of the main shock wave, as well as the formation and subsequent motion of the secondary shock, are given by explicit formulas. In addition, a method for determining (also by explicit formulas) the location of the contact surface between the detonation gases and the outside atmosphere is given. The results of a specific problem, which has been solved by numerically integrating the total equations of motion, and has also been checked experimentally, are compared with the results of the present theory.

FROLOVA, A. V. See Halperin, E. I.

FULTON, A. S. See Bennett, R. R.

GAL'PERIN, also spelled Halperin.

GAL'PERIN, E. I., "Grouping of the First Kind and a Method for Obtaining Multicomponent Azimuthal Seismograms," Bull. Akad. Sci. USSR, Geophys. Ser., 1957, No. 9, pp. 1-23.

VESIAC No. 1703 This paper proposes a method for grouping of the first kind (azimuthal grouping), which makes it possible to change the direction of the axis and the sensitivity of the directivity diagram of a group. Equations are obtained for the azimuthal grouping, and a method is evolved for obtaining multicomponent azimuthal seismograms by means of azimuthal arrangements with few components. A brief description of the relevant apparatus (polarization seismic analyser) is given and the azimuthal seismograms obtained by the proposed method are reproduced.

GAL'PERIN, E. I. See Aksenovich, G. I.

GAMBURTSEV, G. A., "Some New Methods of Seismological Investigation," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 12, pp. 1-8.

VESIAC No. 1715 This article is a detailed outline of various promising, new research areas in seismology.

GAUVIN, H. P. See Cahill, J. P.

GERRARD, J., "Considerations of the Standardization of Seismometers to be Used in the Geneva Network," Technical Aspects of Detection & Inspection Controls of a Nuclear Weapons Test Ban, Part 2, Append. 5, U. S. Government Printing Office, Washington, D. C., 1960, p. 820.

VESIAC No. 781-A20 Standardization of seismometers for the Geneva network is essential for consistent records and for high-speed machine analysis. The three components of ground motion as a function of time must be accurately measured. The types of seismometers, their bandwidths, and their sensitivities are difficult to specify because of the lack of knowledge of the amplitude and spectral content of seismic signals and seismic noise. The transfer characteristics of transducers and related equipment must be analyzed; the ground-to-seismometer noise may be especially troublesome. These characteristics may be analyzed in terms of transient responses in the field, or in terms of steady-state responses in the laboratory. Error detection and evaluation will have to be studied. Seismometer outputs may be translated into binary, octal, or decimal codes through a variety of transducer mechanisms: voltage comparators, cathode-ray tubes with code plates, optical-pattern plates, and acoustic or electromagnetic resonant-frequency detectors. A study of codes and transducers should produce many efficient designs. A 6-phase technical program to standardize and calibrate the seismic instruments is estimated to require 2 years at $200,000 and 8 man-years each.

GILBERT, F., and S. J. LASTER, "Experimental Investigation of PL Modes in a Single Layer," Bull. Seis. Soc. Am., 1962, Vol. 52, No. 1, pp. 59-66.

VESIAC No. 1853 A two-dimensional seismic model has been set up to simulate the problem of elastic-wave propagation in a single layer overlying a uniform half space. Both the source and the receiver are mounted on the free surface of the layer. Seismograms are presented as function of range. In addition to the Rayleigh and shear modes, PL modes are observed. Experimentally determined phase and group velocities compare fairly well with theoretical curves. The decay factor for PL is maximum at the arrival time of P waves in the half space. There is also a secondary maximum at the arrival time of P waves in the layer. Although the decay of PL is small, phase equalization of PL does not yield the initial pulse shape because the mode embraces a frequency band inadequate to permit good resolution.

GILBERT, F., and J. F. MAC DONALD, "Free Oscillations of the Earth, I, Toroidal Oscillations," J. Geophys. Res., 1960, Vol. 65, No. 2, pp. 675-693.

VESIAC No. 1922 The free periods of toroidal oscillations of the earth have been computed for two earth models. The lowest period for the Gutenberg model earth is 2651 seconds and for the Jeffreys-Bullen model 2732 seconds. The surface amplitudes of the oscillations have been computed for three kinds of delta-function stress sources—a unit force, a unit couple, and a unit torque—at depths of 600, 250, 100, and 30 km. The amplitudes decrease with increasing depth of the source. For a unit couple at 600 km, the maximum amplitude of the lowest period for the Gutenberg model is 1.59×10^{-25} cm, and for the Jeffreys-Bullen model it is 0.70×10^{-25} cm. By using the free periods of oscillation, we have extended Love-wave phase velocity and group-velocity dispersion curves to include long-period Love waves.

The method used to compute the periods and amplitudes of the free oscillations is an extension of the Thomson-Haskell matrix method used in plane layered media.

An example is presented to show the correspondence between the free oscillations and ray theory.

GILBERT, F. See Knopoff, L.

GILLULY, J., "Geologic Contrasts Between Continents and Ocean Basins," in Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., 1955, pp. 7-18.

VESIAC No. 1034 Isostasy implies that the differences in surface elevation of continents and ocean basins must reflect differences in density that in turn imply gross lithologic contrasts between these crustal segments. Some petrologists infer that tholeiites and magmas which are wholly continental are more siliceous. Oceanic rocks, collected from islands,

may not fairly represent the oceanic crust, but at any rate they do not differ sharply from continental rocks.

The secular loss of sialic material to the pelagic areas requires that the continents should be either lower or smaller than in the past, unless there has been concurrent addition to the sial from the mantle.

The contrasts between continents and ocean basins invite study of the visible processes now operating to modify them. These processes, though powerful, do not seem to account for the diversities.

The shore line is critical in dynamical geology. Sediment is now being carried across this boundary at a rate sufficient to erase all the topography above sea level in less than 10 million years, if compensating uplift did not occur. An analysis indicates that subcrustal flow induced by isostatic response to unloading may influence both coastal structures and differentiation of sial, but such flow does not in any way explain the contrast between Pacific and Atlantic structures, nor can it be the governing factor in orogeny. These must result from other movements deep within the mantle, perhaps piloted by the shallow movements.

GILMAN, R. See Phinney, R.

GILVARRY, J. J., "Origin of Lunar Surface Features and of Terrestrial Ocean Basins and Continents," in Proc. Geophys. Lab. Cratering Symposium, Part II, Rept. UCRL-6438, 1961, pp. R1-R34.

VESIAC No. 1146-R Both cosmic and geological evidence indicate that the terrestrial atmosphere and hydrosphere are secondary in origin, formed by exudation from the earth's interior. If a similar origin is postulated for a lunar atmosphere and hydrosphere, the amounts of constituents present initially at a primordial time on the moon can be inferred. The results indicate that the pristine lunar hydrosphere lasted a time of the order of two billion years, and once attained a depth of about 2 km over the lunar lowlands.

The points of analogy between the lunar maria and the basins of terrestrial oceans are pointed out, and it is postulated that both features had a similar origin, i.e., by explosive impact of large meteorites in the presence of a hydrosphere.

GLIVENKO, E. V., "Determining a Magnitude by Excess Observations in Seismological Problems," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 7, pp. 696-700.

VESIAC No. 1385 This article consists of a statistical treatment of seismic observations. A method of determining the most probable value of an unknown quantity with an excess number of observations is described. Assuming the use of records from several stations, such quantities might be the hypocenter of an earthquake, the energy of an earthquake, the dynamic parameters of a focus, and others. The method proposed here is based on examining the probability function. The question of finding the most probable hypocenter of an earthquake is discussed in detail.

GLIVENKO, E. V., "On the Evaluation of Accuracy in the Determination of the Hypocenters of Earthquakes," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 4, pp. 363-368.

VESIAC No. 1351 The paper examines the probability method in the evaluation of the accurate determination of an earthquake hypocenter. It is assumed in this case that an error in determining the location of the focus depends upon inaccuracies in time readings, but does not depend on the interminable inhomogeneity of the medium.

The evaluation of accuracy is made by constructing the function of error distribution. Some specific cases of determining the hypocenter of an earthquake by the methods of Wadati and Ishikawa are analyzed.

GODIN, YA. N., B. S. VOL'VOVSKI, I. S. VOL'VOVSKI, and K. E. FOMENKO, "Determination of the Structure of the Earth's Crust by Means of Regional Seismic Investigations on the Russian Platform and in Central Asia," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 10, pp. 955-960.

VESIAC No. 1608 This paper presents results of investigations of the earth's crust which have been carried out upon the Russian Platform and in Central Asia by the All-Union Scientific Research (VNI) Institute for Geophysics.

A brief description is given of the observed seismic waves, of the method of field observation. The direction of further studies of the earth's crust is considered.

GOEDICKE, T. R., Some Geological Results of Underwater Sound Measurements in the Bahamas, Rept. No. ML 610338825, Univ. of Miami, Coral Gables, Fla., 1960.

VESIAC No. 1131
AD 252 214 A series of experiments on underwater sound transmission was carried out in the Tongue of the Ocean, Bahamas, by the personnel of the David Taylor Model Basin. A vertical hydrophone array extending from the surface to 600 feet was used to pick up direct sound waves and echoes from 4.5 lb TNT charges detonated at different depths. The sound impulses were recorded on magnetic tape, and the impulses from the different hydrophones were recorded simultaneously on different tracks. The distance from the shot points to the hydrophone array varied from 520 to 840 yards.

The resulting seismograms were corrected and composite record sections made. These were used in interpretation of sub-bottom echoes and elimination of bubble pulse arrivals and multiple reflections.

The results indicate that a considerable thickness of sediments underlies the bottom of the Tongue of the Ocean, including the southeastern part where no seismic work had been done to date. Further measurements are required in order to permit correlation of reflecting horizons over considerable distances and to determine structural trends.

GOTSADZE, O. D., "The Dynamic Characteristic of Earthquakes in the Caucasus," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 3, pp. 13-29.

VESIAC No. 1671 The dynamic parameter of fifty earthquakes in the Caucasus (basically the Shemakha, Akhalkalaki, Daghestan and Prikazbed zones) are determined. A theoretical scheme of the foci in the Caucasus is established experimentally as a dipole moment. The accuracy of the interpretation is evaluated. The general properties of dislocations in the foci in each zone are described, and a preliminary comparison of these properties with the tectonics is given.

GRATSINSKY, V. G., "Distortions of the Spectra of Seismic Pulses by Resonance Analyzer and a Method of Eliminating Them," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 10, pp. 970-977.

VESIAC No. 1610 This paper treats the distortions of pulse spectra caused by dampening of the resonator of a resonance analyzer. Quantitative requirements which, if fulfilled, would reduce errors in the analysis to permissible limits are determined. A simple practical method of checking the accuracy of the analyzer is described and a method of eliminating errors due to damping of the resonator is suggested.

GURVICH, A. S. See Volarovich, M. P.

GUTENBERG, B., "The Cooling of the Earth and the Temperature in its Interior," in Internal Constitution of the Earth, Dover Publs. Inc., New York, N. Y., 1951, pp. 150-166.

VESIAC No. 555 Probably the increase in temperature downward at greater depths is smaller than is frequently believed. The temperature in the center of the earth is probably closer to 2000°C than to 5000°. The interior of the earth seems to be cooling very slowly, if at all. It is possible that at least parts of the continental crustal layers are getting hotter at present. The earth may have started as a cold body and is getting hotter. The answers to several of the questions involved here are likely to be changed by new data.

GUTENBERG, B., "The Elastic Constants in the Interior of the Earth," in Internal Constitution of the Earth, Dover Publs. Inc., New York, N. Y., 1951, pp. 364-381.

VESIAC No. 557 Rigidity increases inside the earth, with increasing depth, from about 10^{10} dynes/cm^2 in recent sediments to approximately the following: 3×10^{11} in the "granitic" layer of the continents; 6.5×10^{11} at 100 km; 10^{12} at a few hundred kilometers; 2×10^{12} between 1,000 and 1,500 km; and 4×10^{12} in the mantle near the core at 2,900 km. Inside the core the rigidity is noticeably less and probably of a smaller order of magnitude. Even if the rigidity in the core corresponds to that of a true fluid, the earth would be stable on account of the high bulk modulus in the core.

In the crust and the mantle, the bulk modulus is about twice the coefficient of rigidity, but continues to increase inside the core slightly beyond 10^{13} dynes/cm^2. Young's modulus of elasticity is between 2 and 3 times the coefficient of rigidity, and decreases similarly at the

boundary of the core. Poisson's ratio seems to increase, not quite regularly with depth, inside the mantle from about 0.25 in the crust to about 0.3 near the core; inside the mantle, in general, 0.27 is a good approximation. Inside the core it is probably not far from 0.5.

GUTENBERG, B., "Hypotheses on the Development of the Earth," in Internal Constitution of the Earth, Dover Publs. Inc., New York, N. Y., 1951, pp. 178-226.

VESIAC No. 554 This report presents twenty "laws" on the development of the earth. Problems and hypotheses concerning the early history of the earth, its composition, and the formation of the core are discussed: the earth was probably formed as a separate body 2 1/2 to 3 1/2 thousand million years ago; the formation process is disputed; whether the earth started as a cold or hot body is argued; there is not agreement as to how the elements were distributed in the earth; during the history of the earth, the period of its rotation has apparently lengthened.

Included in the discussion are hypotheses concerning subcrustal currents, contraction, changes in climate and movements of the poles, and relative movements of large parts of the earth's crust.

GUTENBERG, B., "Two Types of Microseisms," J. Geophys. Res., 1958, Vol. 63, pp. 595-596.

VESIAC No. 595 In general, microseisms are a nuisance. It is not at all unusual to observe microseisms which have traveled over distances of continental proportions. A 3-station array was established on Mt. Palomar to investigate microseisms. It was found that the waves almost always come from the coast, with the direction of approach generally lying between north-northwest and south-southwest. Among the many types of microseisms observed are the two-second microseisms with wavelengths between about 1/3 and 1/2 the wavelength of the six-second waves and with practically the same velocity. Thus far, very little is known about these waves. Whereas the six-second waves can propagate across distances of continental proportions, the two-second waves are never observed very far inland—probably not beyond about 10 wavelengths.

GUTENBERG, B., and C. F. RICHTER, "Structure of the Crust: Continents and Oceans," in Internal Constitution of the Earth, Dover Publs. Inc., New York, N. Y., 1951, pp. 314-339.

VESIAC No. 551 The surface of the earth is divided into two areas which are characterized by different structures. The first includes the Pacific basin, possibly with a few outlying regions; the second comprises the remainder of the surface, with two major subdivisions—one, the present continents and continental seas, the other the Atlantic and Indian Oceans. The margins of the Pacific basin are largely parallel to mountain chains which are frequently folded in arcs convex toward the basin. Most of the margin of the Pacific area is associated with great seismic activity. The boundary between the two chief structural units (Pacific

and continental) apparently goes down at least 40 km, and in some way affects conditions down to at least 700 km. The distinction between the two chief structures is evidenced by higher or lower velocity of surface waves over paths of different character, and by smaller or larger amplitudes of reflected longitudinal waves. The typical continental structure consists of a series of layers, the uppermost of which is that of the sedimentary rocks. The elastic constants within this layer are subject to much local variation. The velocity of longitudinal waves in the "granitic layer" apparently increases from about 6 km/sec near the surface to (locally) as much as 6 3/4 km/sec at a depth of about 10 km. Below the upper part of the continental crust called the "granitic layer," one to three crustal layers have been identified. The area of continental structure is traversed by the Alpide belt of Tertiary mountain building, which is accompanied by volcanism and seismic activity. In general, Atlantic coasts are not paralleled by lines of tectonic, seismic or volcanic activity. Seismic and geophysical data for the Indian Ocean are scanty but where available, are of the same character as for the Atlantic. In all parts of the world, gravity observations are consistent with the general description of structures thus far outlined. At depths approaching 80 km, the velocity of seismic waves seems to decrease slightly with increasing depth, perhaps as a consequence of a transition of crystalline to vitreous material.

GUTENBERG, B. See also Benioff, H.

GZOVSKY, M. V., V. N. KRESTNIKOV, I. L. NERSESSOV, and G. I. REISNER, "A Comparison of Tectonics and Seismicity in the Garm Region, Tadzhik SSR. II," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 12, pp. 829-839.

VESIAC No. 1312 A quantitative comparison of tectonics and seismicity is being attempted in the Garm region.

GZOVSKY, M. V., V. N. KRESTNIKOV, I. L. NERSESSOV, and G. I. REISNER, "New Principles in Establishing Seismic Regions, Based on an Example from Central Tien-Shan. II," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 3. pp. 235-245.

VESIAC No. 1477 The authors discuss and compare independent evaluations of the seismic hazard on the basis of seismic and geological data. New maps of the seismic regions are presented.

HAGELBARGER, D. W., "A Digitally Encoded Seismometer," Earthquake Notes, 1961, Vol. 32, p. 21.

VESIAC No. 1796 A digital encoder has been built for use with Geotech Models 1051 and 1101 Benioff seismometers. The image of a slit is moved across An 8-channel code plate by a Geotech type 4100-43, 5 cps galvanometer. The slit is illuminated 11 times per second by a Xenon flash lamp. Light pulses passing through the code plate are received by 8 photomultiplier tubes which set cores in a magnetic-core logic circuit. The

logic circuit converts the code for serial transmission and adds a parity-check digit, which is used both for error detection and word synchronization.

The code plate uses a compressed code so that the smallest step corresponds to an earth motion of 0.5 mμ. Full-scale earth motion is 0.5 μ peak-to-peak. The flash lamp and photomultipliers have passed an accelerated life test equivalent to six months' usage without appreciable deterioration.

The encoder is designed for unattended remote locations and uses less than 0.4 watts total power.

HALPERIN, also spelled Gal'perin.

HALPERIN, E. I., and A. V. FROLOVA, "Azimuth-Phase Correlation of Elliptically Polarized Seismic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 2, pp. 134-141.

VESIAC No. 1471 The theory of the azimuth-phase correlation of elliptically polarized waves is examined. The features of azimuthal seismograms are investigated. Methods are proposed for the solution of the converse problem of finding the wave-polarization parameters.

HALPERIN, E. I., and A. V. FROLOVA, "Three-Component Seismic Observations in Boreholes, I," Bull Acad. Sci. USSR, Geophys. Ser., 1961, No. 6, pp. 519-528.

VESIAC No. 1576 Consideration is given to two trends in the development of the procedure for seismic observations in boreholes: vertical seismic profiling and study of the polarization of seismic waves. The possible applications of these observations to prospecting are considered. In the first part of the article, the vertical hodographs of direct, reflected and head (longitudinal and converted) waves are examined for the simplest case of the structure of the media. Combined horizontal and vertical hodographs are given. Field work is described and determination of the nature of a converted reflected wave of type PS is demonstrated.

HAMMON, S., "Effect of Water Table on Blast Vibrations," Earthquakes Notes, 1960, Vol. 31, pp. 51-52.

VESIAC No. 102 This informal article considers the relation of the water table to blast vibrations. Four dynamite test blasts were set off and recorded at AEC installations in New Mexico. Five-pound charges were used, and conditions were varied for each shot. One pair of shots, with the water table 13 feet below the surface of the ground, produced almost identical recorded magnitudes (.0345 inch displacement, 8 cps; and .0375 inch displacement, 8 cps) from charges of the same weight set off at very different distances from the seismograph. For the first of this pair of shots, the seismograph was 170 feet from the charge and 2 feet below the water table; for the second, 25 feet from the charge and 4 feet above the water table.

HARKRIDER, D. See Press, F.

HASKELL, N. A., "The Dispersion of Surface Waves on Multilayered Media," Bull. Seis. Soc. Am., 1953, Vol. 43, No. 1, pp. 17-34.

VESIAC No. 1881 A matrix formalism developed by W. T. Thomson is used to obtain the phase-velocity dispersion equations for elastic surface waves of Rayleigh and Love type on multilayered solid media. The method is used to compute phase and group velocities of Rayleigh waves for two assumed three-layer models and one two-layer model of the earth's crust in the continents. The computed group-velocity curves are compared with published values of the group velocities at various frequencies of Rayleigh waves over continental paths. The scatter of the observed values is larger than the difference between the three computed curves. It is believed that not all of this scatter is due to observational errors, but probably represents a real horizontal heterogeneity of the continental crusts.

HAWLEY, P. F. See Sparks, N. R.

HEALY, J. H., and F. PRESS, "Further Model Study of the Radiation of Elastic Waves From a Dipole Source," Bull. Seis. Soc. Am., 1959, Vol. 49, No. 2, pp. 193-198.

VESIAC No. 326 This study of elastic waves generated in a two-dimensional ultrasonic model using a single source adjacent to a long slit reveals that Rayleigh waves are generated along the edge to the end of the slit, from which point the waves are transmitted as shear waves into the body of the medium. The two-dimensional Rayleigh wave diminishes in amplitude with distance due to adsorption. A reflected Rayleigh wave is also observed. The amplitude of the shear wave from the end of the slit away from the source decreases with increasing azimuth from the projected axis of the slit, but this decrease is more rapid on the side of the slit adjacent to the source.

HECK, N. H. See Wood, H. O.

HEEZEN, B. C., and M. EWING, "The Mid-Oceanic Ridge and its Extension Through the Arctic Basin," in Geology of the Arctic, Univ. of Toronto Press, Toronto, Ont., 1961, pp. 622-642.

VESIAC No. 1049 A belt of earthquake epicenters crosses the Arctic Basin from the vicinity of the Verkhoyansk Range of Siberia to the Spitsbergen-Greenland strait, after which the belt continues through the Norwegian Sea, follows the central graben across Iceland, and joins the seismic belt of the Mid-Atlantic Ridge. Investigations of the latter have shown that the earthquake epicenters do not scatter across the full width of the ridge, but are inclined to a central rift valley which is invariably found close to the axis of the ridge. The Mid-Atlantic Ridge is found to be a short section of a world-encircling mid-oceanic ridge system which extends through the Indian and the South Pacific oceans.

Although the existence of an earthquake belt in the Arctic Basin has been long recognized, the presence of a rifted ridge following this belt has not previously been claimed. The writers find that the soundings of Fram and Sedov, when reinterpreted in the light of the mid-oceanic ridge, are not inimical to this concept. The extension of this belt through the rift valleys of Africa and the central graben of Iceland suggests that extension is characteristic of the whole system. Accordingly, that portion of the Arctic Basin between the Lomonosov Ridge and the Eurasian continental shelf is growing wider.

HEEZEN, B. C. See Ewing, M.; Talwani, M.

HEIRTZLER, J. R., "The Longest Electromagnetic Waves," Sci. Am., 1962, Vol. 206, No. 3, pp. 128-137.

VESIAC No. 1165 Sensitive magnetometers commonly detect oscillations with a period of 100 seconds and a wavelength of 18,600,000 miles. At present the mere detection of such waves presents the principal challenge to the investigator. When the messages they carry are understood, they may tell a great deal about the electrodynamic interaction of the earth and the sun, and provide a new way to look into the earth's interior. If the angle between the electric and magnetic components of these waves could be measured, it would yield the distance to the source of the radiation. Discovery of where the waves come from will probably provide the answer to the question of how they originate. The most important conclusion so far is that waves with periods of one to 100 seconds originate mostly, if not entirely, above the earth's surface and come in at a vertical, or nearly vertical, direction.

HELFENSTEIN, H., Relations Between the Time-Distance Surface and a Discontinuity Surface in Seismic Reflection, Tech. Rept. No. 36, Dept. of Math., Stanford Univ., Stanford, Calif., 1954.

VESIAC No. 1180
AD 27 629

The general relations between an arbitrarily curved discontinuity surface D and the corresponding time-distance surface S are analyzed. A parametric representation of S is determined from that of D by assuming that the velocity of the seismic waves is constant and is known in the surface layer down to the discontinuity surface D; waves originating from a shot at the origin of the imposed coordinate axes are reflected at D. The correspondence between the discontinuity surface D and the time-distance surface S is interpreted as a contact-transformation T. The latter associates a hyperboloid H to each point $p \epsilon D$, so that if p describes D, then H envelopes S. This interpretation solves the problem of determining D from S, because if S is known, the inverse transformation T^{-1} can be used to find D. A simple graphical method of constructing D is obtained from a geometrical study of T^{-1}, and corresponding curves on D and S are discussed.

HERNDON, J. See Flammer, C.

HERRIN, E., and J. RICHMOND, "On the Propagation of the Lg Phase," Bull. Seis. Soc. Am., 1960, Vol. 50, No. 2, pp. 197-210.

VESIAC No. 1885 Empirical determinations of the mean surface velocity of Lg indicate a range from 3.47 to 3.54 km/sec, with one set of velocities off the east coast of Mexico as low as 3.20 km/sec. Computations based on ray theory show that Lg with these velocities may be shear waves guided in the upper crust by an alternation of refractions and surface reflections. The slower velocities would result from shear waves traveling almost entirely in the sedimentary layer. Polarization of Lg is related to the angle at which the guided shear waves are incident at the surface.

Calculations show that Lg would travel in a continental crust covered by a considerable thickness of water; this phenomenon supports the hypothesis that the absence of Lg indicates that an oceanic crust underlies such bodies of water as the Gulf of Mexico.

HERZBERG, G., and G. R. WALKER, "Initiation of High Explosives," Nature, 1948, Vol. 161, No. 4095, pp. 647-648.*

VESIAC No. 877 The spread of the detonation wave near the point of initiation is discussed. In the experiments described a rotating mirror camera with an image speed of 2,000 m/sec was used; this permitted the study of changes in the detonation waves within much smaller intervals of space and time than a number of other students of the problem have worked with. Contrary to certain previous results reported by others, in all cases investigated by the authors, the apparent centre of the spherical detonation wave is some distance (initiation distance) in front of the detonator. It appears to the authors that the proper interpretation of their results can only be that the detonator sets up a low-order detonation, which, after travelling for a distance, changes within a rather small region of the wave front to high-order detonation.

HOBSON, G. D., "Seismic Exploration in the Canadian Arctic Islands," Geophysics, 1962, Vol. 27, No. 2, pp. 253-273.

VESIAC No. 1155 The Polar Continental Shelf Project, a broad program of research in the Canadian Arctic, was started in 1959. Seismic studies were undertaken by the Geological Survey of Canada. Refraction and reflection techniques were employed in the first stages of a reconnaissance program during May, June, July, and August 1960.

Certain new techniques were developed during this seismic program in the high Arctic. The crew operated from motor toboggans in 1960, but helicopters will be used more extensively in the future for a more efficient operation. Adverse weather conditions such as blizzards, low temperatures, white-outs, wind, and rain are a hindrance to operations at various times of the year.

The sea ice appears to present no great noise problem to standard recording techniques. Several air shots were recorded in direct comparison with surface shots, but the gain in energy level is not enough to justify using the method. The records from various locations within the Sverdrup Basin indicate that both reflection and refraction techniques are satisfactory. A cross-section illustrates the results of the 1960 program.

HODGSON, J. H., "Nature of Faulting in Large Earthquakes," Bull. Geol. Soc. Am., 1957, Vol. 68, pp. 611-644.

VESIAC No. 2010 The Dominion Observatory, Ottawa, Canada, has applied Byerly's method to determine the direction of faulting in 65 earthquakes (making a total of 75 earthquakes so analyzed). To date, ten solutions have received some confirmation by comparison with observed faulting.

The method is ambiguous in that two planes, neither of which is indicated as the fault, are defined for each solution. This does not obscure the fact that of the 75 earthquakes, all but eight resulted from strike-slip faulting. Of these, five are on the Pacific coast of North America, two in the Hindu Kush, and one was an anomalous deep-focus earthquake off the coast of Spain. Otherwise, for all circum-Pacific areas and for the Mediterranean, and for focal depths ranging from 12 to 650 km, strike-slip faulting appears to be the rule. Within any area the strike directions of the faults appear to be random. The dip direction on the other hand may have some consistent orientation. This apparent inconsistency could be explained by supposing that planes whose strikes deviate from a favored direction tend to develop very steep dips.

In any solution the intersection of the two planes defines a unique line, here called the null vector. No matter which plane represents the true solution, this vector is perpendicular to the displacement couple and so undergoes no displacement—hence its name. In the southwest Pacific, the null vectors lie parallel to vertical planes striking in the direction of the associated geographical features. In other circum-Pacific areas the correlation is less certain, but it is still definite enough to suggest a considerable measure of confidence in the validity of the fault-plane techniques.

HODGSON, J. H., and W. M. ADAMS, "A Study of Inconsistent Observations in the Fault-Plane Project," Bull. Seis. Soc. Am., 1958, Vol. 48, No. 1, pp. 17-31.

VESIAC No. 1917 The 65 solutions published in the fault-plane project of the Dominion Observatory have been based on 2476 observations of P and 722 observations of PKP. Of these observations 18.3 per cent have been inconsistent with the published solutions, but a small number of stations have contributed a high percentage of these inconsistencies. Applying a criterion of rejection to the data reduces the percentage of inconsistencies to 14%. Since most stations have tried to cooperate as fully as possible in the program, and have reported observations even when the arrivals were recorded only as weakly emergent phases, this percentage seems satisfactorily small.

Because the circles represent the boundaries between zones of compression and zones of dilatation, it might be expected that a higher percentage of inconsistencies would occur close to the circles. The reverse has been found; the observations close to the circular boundaries are slightly more accurate than those remote from them.

The inconsistent observations show no significant variation with epicentral distance except that the percentage of inconsistencies is high at the shorter distances. This is the effect of the crustal layers and had been anticipated.

There have been 282 observations of PP and 135 observations of pP. These observations were examined to determine whether they could be used to determine the value of Poisson's ratio under the continents and under the oceans. It was found that the percentage of inconsistencies was too high to allow a final conclusion.

There were 17 observations of PcP. These were examined following a method suggested by Båth in an attempt to define the density ratio at the boundary of the core. The attempt was a failure because of the inconsistency of the data.

The failure of the reflected phases suggested that the data from them might be random. To test this, 23 new solutions were carried out based only on P and PKP data. When the solutions were complete, observations for the reflected phases were plotted on the diagrams. It was found that for all reflected phases, the inconsistencies approached 50 per cent. It is clear that reflected phases, at least when reported by questionnaires, are not sufficiently accurate to be useful in fault-plane studies.

HODGSON, J. H., and W. G. MILNE, "Direction of Faulting in Certain Earthquakes of the North Pacific," Bull. Seis. Soc. Am., 1951, Vol. 41, No. 3, pp. 221-242.

VESIAC No. 1905 Byerly has shown that when stations are plotted in extended position, the initial motion will be compressional in two lunes of the earth and rarefactional in two others (the direction of displacement being opposite in alternate segments). These lunes are formed by the intersection of the earth's surface with the fault plane through the epicenter perpendicular to the motion direction. Certain consequences of the orthogonality of this second plane and the motion direction are here deduced. The extended theory is applied to four earthquakes, one in the Aleutians, one in central Alaska, one in the Queen Charlotte Islands, and one in Vancouver Island. The strike and dip of the fault and the direction of slipping are determined in each case. The seismic results are discussed in the light of other information available.

HOLZMANN, F. M., "Frequency Theory of the Grouping of Signals on a Background of Correlated Noises," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 6, pp. 511-517.

VESIAC No. 1489 The principal properties of the x-representations of regular signals and irregular correlation noises are examined. The grouping of signals is reduced to the filtration of the suitable x-representations. The author examines also the dependences of the quadratic mean amplitude of the noise at the output of the group, and the resultant s/n on the parameters of the group and on the form of the function of the autocorrelation of the noise.

HOLZMANN, F. M., "The Frequency Theory of Interference Systems," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 3-11.

VESIAC No. 1459 This paper examines problems of the synthesis of interference systems for the separation of waves having different apparent veloc-

ities in the directions of the coordinate axes. In the general case, the synthesis of interference systems is reduced to the selection of three-dimensional frequency characteristics and to the calculation of their reciprocal Fourier integral. The frequency characteristics of the discrete systems are periodic. An examination is made of the basic concepts of the theory of filtration of velocities on the basis of which the frequency characteristics are selected. The article adduces examples of the synthesis of interference systems by the assumed values of the apparent velocities of effective and interference waves.

HOLZMANN, F. M., "On the Experimental Analysis of Interferences of the Reliability of the Results of the Grouping of Signals," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 12, pp. 1140-1146.

VESIAC No. 1530 The author investigates the fundamental characteristics of x- and t-expressions of a signal and of an interference. Some methods of the experimental analysis of these properties are examined. The results of the grouping of signals appear to be reliable only on the condition that the spectra of the x-expressions of an effective signal and of the interference are separated. Some qualitative criteria of reliability evaluation are suggested.

HOLZMANN, F. M., "The Selection of Frequency Characteristics of Filters for Seismic Signals," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 4, pp. 378-384.

VESIAC No. 1354 This paper introduces the criterion which permits one to find, by using the characteristic spectrum, the approximate time of arrival and termination of the signal. The same criterion is applicable in the determination of the cutoff frequency of the spectrum of the given signal. Here it is shown that the effective duration of the pulse is basically determined by the steepness of the front slopes of the individual extremes of the real and imaginary components of the spectrum. The cutoff frequency of the spectrum depends on the steepness of the fronts of the individual extremes of the signal. General conclusions are given which should be taken into consideration when selecting the filters, particularly the high-frequency filters.

HOLZMANN, F. M., "Statistical Evaluation of the Reliability of the Results of the Grouping of Signals," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 12, pp. 1147-1153.

VESIAC No. 1531 The author suggests a probability evaluation of the reliability of the axes of cophasality obtained in the grouping of signals. He then examines some practical methods for the calculation of the reliability and the dependence of the reliability of the axes isolated on the conditions of the experiment.

HOLZMANN, F. M. See Kalinina, T. B.

HONDA, H., and K. EMURA, "The Production of the Two-Dimensional Elastic Waves," Geophysics, 1956, Vol. 8, pp. 206-211.

VESIAC No. 2015 The writers study the problems of the production of the two-dimensional elastic waves by the force systems of various types applied normally on a straight line in an infinite elastic solid. The results may be useful for the experimental studies of the production of the elastic waves of ultrasonic frequencies propagated through small-scale two-dimensional models.

HOOD, H., "A-Bomb Detection Program Spurs Seismology and Instrumentation," Electronics, 1962, Vol. 35, No. 8, pp. 28-29.

VESIAC No. 968 An A-bomb detection program which will be used to detect and evaluate nuclear blasts in distant parts of the world is leading to rapid improvement of seismic techniques. At a new data-analysis and technique-development center in Washington, D. C., the prime concern will be the differentiation between signals emanating from nuclear blasts and from the more than 20,000 earthquakes which are detected each year. The center will also develop new techniques and instrumentation for more effective detection and evaluation. Seismic information will be fed into the center from a farflung network of 40 fixed and mobile recording stations. A huge seismic laboratory, closely related to the center, will be, when completed, the primary development and evaluation laboratory for systems being developed for this project. One of these systems, at Phoenix, obtains information from 31 seismometers buried in the ground in steel vaults. These detectors include instruments of various types in an array four miles in diameter. One function of the center in Washington will be to seek ways of representing seismic data more simply, in order to reduce the required communication bandwidth.

HOOK, J. F., M. H. LOCK, and T. KARLSSON, A Theoretical Study on Propagation of Seismic Waves in an Inhomogeneous Earth, Semi-Ann. Tech. Sum. Rept., Contr. AF 49(638)-1082, Nat. Eng. Sci. Co., Pasadena, Calif., 1961.

VESIAC No. 979 VU The work described here is concerned with analytical studies of the effect of the earth's inhomogeneity on the propagation of seismic waves. (Inhomogeneous media are defined as media in which the properties vary continuously with position.) The authors attempt to extend the method of potentials to more types of media and more general wave symmetries, and to formulate and solve representative boundary and initial value problems of propagation in inhomogeneous media. The report contains what is probably the first exact solution of a transient boundary-value problem involving P and SV waves in inhomogeneous media. The use of the generalized potential method has now shown that for inhomogeneous media the P and SV waves are not necessarily irrotational and solenoidal, respectively.

HOUSNER, G. W., Analysis of the Taft Accelerogram of the Earthquake of July 21, 1952, Calif. Inst. Tech., Pasadena, Calif., 1953.

VESIAC No. 1175
AD 19 011 In a previous report of work done under contract with the Office of Naval Research, the spectra of all suitable strong-motion earth-

quake accelerograms recorded prior to August, 1951, were presented. On 21 July 1952 a strong earthquake occurred in the region of Arvin and Tehachapi, California. The ground accelerations were recorded at Taft, California on an instrument maintained by the U. S. Coast and Geodetic Survey. The present report gives the spectra as computed from the Taft accelerograms.

HOUSNER, G. W., A Dislocation Theory of Earthquakes, Calif. Inst. Tech., Pasadena, Calif., 1953.

VESIAC No. 1220
AD 17 734

A mechanism for the generation of seismic waves is postulated that is based on the release of shear strain dislocations. A certain probability of release of dislocations is also postulated. From these expressions are deduced for the frequency distribution of shocks, energy released, etc., that are in agreement with observations. It is shown that a random superposition of pulses such as those released by individual dislocations will form an accelerogram that has the appearance and properties of recorded accelerograms. The relation between the maximum ground acceleration and the size of the slip area is examined. It is concluded that the existing recorded strong-ground-motion accelerograms are reliable samples of possible strong ground motion.

HOUSNER, G. W., Earthquake Pressures on Fluid Containers, 8th Tech. Rept., Calif. Inst. Tech., Pasadena, Calif., 1954.

VESIAC No. 1169
AD 64 078

The dynamic fluid pressures developed during an earthquake are of importance in the design of structures such as dams, tanks, and caissons. With certain known solutions as checks on accuracy, it is possible to derive solutions by an approximate method which avoids partial differential equations and series and presents solutions for a number of cases in simple closed form. This approximate method seems particularly suitable for engineering applications. The essence of the method is the estimation of a simple type of flow which is similar to the actual fluid movement; this simple flow is used to determine the pressures. The method is applied to rectangular, circular, elliptical, and composite tanks; and it is applied to rectangular, trapezoidal, stepped, and segmental dams.

HOUSNER, G. W., Intensity of Ground Motion During Strong Earthquakes, 2nd Tech. Rept., Calif. Inst. Tech., Pasadena, Calif., 1952.

VESIAC No. 1755
AD 199 170

A measure of the surface intensity of the ground motion during an earthquake is defined which is proportional to the maximum stresses produced in structures. Intensities are computed for 14 strong-motion shocks, and these are compared with the Modified-Mercalli Intensities for the same earthquakes. A method is developed for computing the magnitude of an earthquake from the intensity (and vice versa). This method permits the intensities to be calculated over the area affected by the earthquake. The maximum intensity and the maximum ground acceleration likely to be experienced by a California city are estimated. The frequency with which strong earthquakes are likely to occur in

California is determined, and an estimate is made of the probable frequency of severe ground motion for a California city.

HOUSNER, G. W. See Alford, J. L.

HOWELL, L., C. KEAN, and R. THOMPSON, "Propagation of Elastic Waves in the Earth," J. Geophys., 1940, Vol. 5, No. 1.

VESIAC No. 1830 This article describes an investigation of elastic-wave propagation in near-surface materials using single-frequency continuous waves and pulses over a range of 20 to 1400 cps. While only touching upon the diverse problems involved in a study of this kind, the results indicate a complexity requiring considerable research if a proper understanding, commensurate with the importance of the problem, is to be attained.

HOWELL, B. F., and S. P. MATHUR, "Recognition of Seismic Pulses by Studies of Their Frequency Spectra," Earthquake Notes, 1956, Vol. 27, pp. 23-26.*

VESIAC No. 919 Seismograms of vertical components of ground motion at distances from 10 to 1000 feet from a small buried charge were studied. The frequency spectrum was analyzed by the method, developed by Andrews, of using a photomechanical analyzer to make a harmonic analysis of an interval including a transient pulse. The object was to identify by frequency the compressional pulse (A), the coupled wave as defined by Leet (B), and the combination of overlapping Rayleigh and Love waves (C). Analysis, performable only for distances greater than 50 feet, indicated a systematic decrease in the predominate frequency (F) with horizontal distance (d) out to 210 feet. This decrease can be described mathematically as $F = 43.3 - 14.3 \log d$. The frequency spectra of pulses A and C are distinctly different, but the spectrum of pulse B resembles that of A from 90 to 280 feet, and from that distance on resembles C. Graphs of frequency distributions with distance are presented for the three pulses.

HUTH, J. H., Estimating Ground Motions Resulting from Air-Induced Ground Shocks, Rept. No. RM-1762, The RAND Corp., Santa Monica, Calif., 1956.

VESIAC No. 1185
AD 110 881 This memorandum analyzes underground motions induced by the air blast wave spreading over the earth's surface from the center of bomb blast. The work is part of an attempt to obtain by theoretical means information needed in considering the design and vulnerability of underground structures. The material here is a practical interpretation of the results obtained in a previous RAND study, "Elastic Stresses Produced in a Half-Plane by Steady Moving Loads," (P-884), as they apply to estimating ground motions from air-induced ground shocks. Dimensionless graphs give ground velocities and accelerations resulting from constant-velocity two-dimensional step air-blast loadings, as well as ground accelerations from a constant-velocity delta loading. A wide range of parameters is covered, including the com-

plete range of possible Poisson ratios and seismic wave velocities up to 0.8 of the velocity of the air blast wave.

IOSIF, T., "Seismic Activity on the Territory of the Romanian Peoples' Republic (1957-1959)," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 11, pp. 1066-1069.

VESIAC No. 1616 The paper contains an account of Romanian earthquakes from January 1957 to December 1958 and some deliberations on focal distribution and energies.

ISSAYEV, V. S., "Contribution to a Theory of the Directional Effect of Groups of Seismographs in a Case of Pulse Vibrations. I," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 6, pp. 437-444.

VESIAC No. 1281 A theory of the directional effect of groups of seismographs (shots) has recently been elaborated for application to a case of stationary harmonic vibrations. In seismic prospecting, however, non-stationary vibrations are used (usually quasi-sinusoidal pulses). It is therefore of interest to examine theoretically the characteristic features of the directional effect of a group of instruments in the case of pulses; to see how far it is justifiable to use the theories of grouping for stationary harmonic vibrations in recording pulse vibrations; and to investigate the specific variations in the dynamic and kinematic characteristics of pulsed waves in connection with grouping.

The problem of distortions of the dynamic characteristics of waves when grouping is used has already been examined (on the basis of a graphical analysis) for harmonic vibrations limited in time, but only a qualitative and incomplete study of these distortions is made in the paper referred to.

In the present paper, the writer investigates the directional effect of groups of seismographs in the case of pulsed vibrations, and he examines distortions of the dynamic characteristics of the pulsed waves as a result of grouping; distortions of the kinematic characteristics will be examined in a second part of the paper.

ITO, I., "On the Relationship Between Seismic Ground Amplitude and the Quantity of Explosives in Blasting," Mem. Fac. Eng., Kyoto Univ., 1953, Vol. 15, No. 2, pp. 79-87.*

VESIAC No. 843 The relationship between the seismic ground amplitude and the quantity of explosives charged in the blasting operations is studied. It is assumed that, ideally, the amplitude of the ground movement is proportional to the square root of energy released in the explosion and the energy released is in direct proportion to the quantity of explosives charged. It is noted that in the actual blasting some of the energy will be used in breaking and throwing off the broken rocks in which the explosives are charged and in some other forms of energy. On the basis of experiments carried out in soft ground at the top of a hill, and assuming that all the conditions of blasting are equal, the

writer concludes that the effective charge producing the vibrations is increased as the amount of charge of explosive is increased.

IVAKIN, B. I., "Elastic Media with Imperfect Inertia and Their Models," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 2, pp. 138-144.

VESIAC No. 1330 Absorbing media and their models with imperfect elasticity have been previously investigated; in this report, the author studies media which possess imperfect inertia of masses which cause the absorption of waves.

IVAKIN, B. N., "The Calculation and Modeling of the Absorption of Seismic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 11, pp. 743-754.

VESIAC No. 1306 On the basis of the results of a preceding paper, calculations of the velocity of propagation, the coefficient and decrement of absorption of elastic waves, and the acoustic impedance as a function of frequency are carried out for absorptive media and their models: 1) with elastic afterworking of the Sokolov-Skryabin type; 2) with viscosity (internal friction); 3) with residual deformation. The results of the calculations for absorbing media are discussed; the criteria for similarity for the effects of absorption on elastic waves are considered; the results of experimental investigations by electrical models of the absorbing properties of media mentioned above are presented for pulses and sinusoidal oscillations.

IVAKIN, B. N., "Methods for Controlling the Density and Elasticity of a Medium During the Two-Dimensional Modeling of Seismic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 8, pp. 761-771.

VESIAC No. 1500 This article examines methods for controlling the density and elasticity of thin plates (sheets) by means of a net of holes or elevations, as well as by means of fabricating a plate of variable thickness.

IVAKIN, B. N., "Modeling of Some Geophysical Phenomena on Electrical Grids," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 5, pp. 480-485.

VESIAC No. 1368 The author discusses the possibilities of modeling by electrical grid models the nonlinear processes occurring in earthquake foci and the vicinity of explosions (phenomena of continuity disruption of an elastic medium), as well as the wave phenomena associated with such processes.

He investigates also the possibilities of modeling, by an electrical grid model, electromagnetic waves propagating in a conductive medium. A model is found which reproduces the "scalar process" of electromagnetic wave propagation.

IVAKIN, B. N., "On Modeling of Absorption of Seismic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 7, pp. 468-474.

VESIAC No. 1284 The general methods of determining the continuous mechanical and electrical models of imperfect elastic media are discussed in this article. The examples of imperfect elastic media with afterworking, or with viscosity (internal friction), and with residual deformations, are given and their models are examined and discussed. To obtain such models, the equations of motion and formulas of acoustic impedance are presented. The possibilities of using such models for the purpose of experimental study of the absorption of seismic waves are indicated.

IVANOVA, L. A. See Epinat'eva, A. M.

IVANOVA, T. G., "On the Application of Seismic Frequency Sounding for the Investigation of the Upper Part of a Cross-Section," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 2, pp. 149-153.

VESIAC No. 1472 The paper adduces some new experimental data on the variation in the apparent angles of incidence of waves onto the surface of the earth during the tuning of the apparatus for the registration of various frequencies. It establishes that the angles of incidence of the waves are affected by a soil layer of insignificant thickness.

An interpretation is presented of the dependence of the apparent angle of incidence of a wave on the frequency of the oscillations being recorded; and the velocity in the soil layer, as well as its thickness, have been determined.

IVANOVA, T. G. See Vassil'ev, YU. I.

JACKSON, W. J., S. W. STEWART, and L. C. PAKISER, Crustal Structure in Western United States, Part II: Crustal Structure in Eastern Colorado from Seismic-Refraction Measurements, ARPA Order No. 193-61, U. S. Geological Survey, Denver, Colo., 1962 (OFFICIAL USE ONLY).

VESIAC No. 1126 VU

JAMES, D. J. See Clabburn, E. J.

JARDETZKY, W. S., On Evaluation of Solutions to Equations of Wave Propagation in a Layered Half-Space, Tech. Rept. No. 35, Lamont Geol. Obs., Palisades, N. Y., 1954.

VESIAC No. 1172
AD 32 354 To remove certain discrepancies in solutions of problems of wave propagation in layered media, especially in the case of a two-layered liquid half space first discussed by Pekeris, the author reconsiders the precise meaning of representations used. The existence of real poles on the path of integration used by Lamb and others for real "w" leads to the addition of corresponding residues to the principal value of the integral. They represent the free waves usually superposed on the solutions to yield divergent waves. The question of real and complex poles is clarified for the Pekeris problem, and the new form of solution is given in terms of a branch line integral and residues at

all these poles. The Lamb condition of vanishing potential at infinity is fulfilled.

JARDETZKY, W. S., Period Equation for an n-Layered Half Space and Some Related Questions, Tech. Rept. No. 29, Lamont Geol. Obs., Palisades, N. Y., 1953.

VESIAC No. 1174 An investigation is made of the dependence of phase velocity upon wave length. This dependence is expressed by the vanishing of a determinant which is given by the boundary conditions of a problem. The period equation is obtained in this manner in its general form, and some conclusions are given concerning the general solutions from such a convenient form. A discussion is given of the roots of the period equation.

JAROSCH, H. See Pekeris, C. L.

JOHNSON, G. W., "Peaceful Nuclear Explosions: Status and Promise," Nucleonics, 1960, Vol. 18, No. 7, pp. 49-53.

VESIAC No. 971 This article discusses the AEC's PLOWSHARE Program, including Project GNOME, Project OIL SAND, and Project CHARIOT. Of particular interest to seismologists is a short section entitled "Earth's Structure and Seismology." The writer notes that the major uncertainties in earthquake seismology are time, source energy, and location and depth of focus of the generating source. With a nuclear source, in contrast to earthquakes, the location, time of detonation, and energy release can be accurately controlled. Valuable seismic information can thus be obtained. A source fired in the Antarctic could reveal valuable information; this could be done in the tradition of the IGY. (A 100-kt shot here would send strong seismic signals all over the world.) All PLOWSHARE nuclear shots will be fired at specified published times so that the seismic scientific community will be able to take full advantage of the signal.

JOHNSON, J. C. See Cahill, J. P.

KALASHNIKOV, A. G., and E. N. MOKHOVA, "On Short-Period Variations of the Regional Electromagnetic Fields," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 29-31.

VESIAC No. 1462 This report discusses short-period variations of the earth's electromagnetic field (pulsations, pulsation trains, and bays) registered simultaneously at four IGY stations in the USSR.

KALININ, YU. D., "The Organization of the Network of Magnetic Observatories in the U.S.S.R. During the Last 40 Years," Bull Acad. Sci. USSR, Geophys. Ser., 1957, No. 12, pp. 47-56.

VESIAC No. 1718 This report gives a history of the organization of the network of magnetic observatories in the U.S.S.R. up to 1957 and the main results of the work done in them.

KALININ, V. A. See Magnitsky, V. A.

KALININA, T. B., "The Theory of Linear Transformations of Two-Dimensional Magnetic and Gravitational Fields," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 12, pp. 1245-1251.

VESIAC No. 1446 This report studies the theory of linear transformations of potential fields on the basis of frequency analysis and Fourier synthesis. It proposes a method for estimating the errors arising in connection with the transformation to a discrete method of calculation and also those caused by the accumulation of random errors.

KALININA, T. B., and F. M. HOLZMANN, "A Nomographic Method for Output Signal Determination in Linear Filtering Systems," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1136-1142.

VESIAC No. 1434 The report proposes an approximate nomographic method for calculating the convolution integral for discrete values of the given functions. It estimates the calculation error and examines examples of the application of the nomographic method to the solution of various physical problems.

KANE, M. F. See Oliver, H. W., Pakiser, L. C.

KARLSSON, T. See Hook, J. F.

KARUS, E. V., "The Absorption of Elastic Vibrations in Rocks During Stationary Excitation," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 4, pp. 249-254.

VESIAC No. 1269 The propagation and absorption of seismic waves are being investigated by a seismo-acoustical method based on amplitude-phase measurements of elastic vibrations induced by stationary harmonic oscillations in the rock. The different wave types superimposed are

longitudinal, transverse, and surface waves, of which surface and transverse waves prevail. The results of this experimental study enable us to differentiate rocks by their absorption parameters and to determine the physical characteristics of the propagation of elastic waves in such rocks. The results agree with the absorption theory of seismic waves, which takes into account the elastic afterworking in rocks.

KARUS, E. V., and V. B. ZUCKERNIK, "An Ultrasonic Apparatus for Studying the Physical and Mechanical Properties of Rocks Intersected by a Drill-Hole," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 11, pp. 755-761.

VESIAC No. 1307 This article describes a model of an apparatus for making a detailed ultrasonic pulse logging of drill holes. Its working principle is similar to that of ultrasonic defectoscopes and apparatuses for seismic modeling. The authors made tests under laboratory conditions and in a deep hole. They demonstrated that it is possible to make a detailed determination of the velocities of longitudinal and transverse waves in rocks; furthermore, they studied the dynamic pecularities of elastic waves.

KATZ, S., Seismic Study of Crustal Structure in Pennsylvania and New York, Tech. Rept. No. 32, Lamont Geol. Obs., Palisades, N. Y., 1953.

VESIAC No. 1194
AD 20 922 Blasts at two quarries in northern New York and central Pennsylvania were recorded to a distance of 309 km. The data indicated an essentially homogeneous crust with elastic wave velocities possibly increasing with depth. An average crustal thickness for the region was 34.4 km, with no indication of significant differences in thickness between the two areas. Observed compressional wave velocities for the crust were 6.3 and 6.31 km/sec for New York, and 6.04 km/sec for Pennsylvania. The corresponding shear wave velocities were 3.62, 3.60, and 3.61 km/sec. Average upper mantle velocities were 8.14 km/sec for P_n and 4.69 km/sec for S_n. The compressional wave velocity of anorthosite near Tahawus, N. Y., was 6.63 km/sec. No near-vertical reflection from the Mohorovicic discontinuity was observed.

KEAN, C. See Howell, L.

KEILIS-BOROK, V. I., "The Theory of Waves Due to Displacements," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 4, pp. 26-35.

VESIAC No. 1677 This report examines the relation between point sources of elastic waves and the static displacements caused by the passage of these waves. It analyzes the static field, described by the Liav theory of dislocations for a slip dislocation, and examines the possibility of the application of this theory to the representation of the origin. A correct analysis shows that the results of the theory of dislocations agree with the generally accepted conceptions of the displacement origin as a dipole plus a moment.

KEILIS-BOROK, V. I., and A. S. MUNIN, "Magnetoelastic Waves and the Boundary of the Earth's Core," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1089-1095.

VESIAC No. 1427 This report investigates the dispersion, damping, polarization, and excitation conditions for plane magnetoelastic waves. As the field strength H_0 increases, the damping of waves passes a certain maximum and then tends towards zero. Two waves are possible in strong fields: a slow wave, whose velocity lies between the velocities of longitudinal and transverse elastic waves; and a fast wave, whose velocity is proportional to H_0. Only in the slow wave is there intensive mechanical vibration. Whether these waves are close to longitudinal or transverse waves depends on the orientation of the field in relation to the direction in which the waves are propagated, and is practically independent of whether the initial impulse was longitudinal or transverse. The observed distribution for the velocities of seismic waves in the D layer can be explained by assuming a linear increase in the gradient k/p and a decline in u/p compensated by the magnetic field.

KEILIS-BOROK, V. I., and I. M. STESIN, "The Dispersion of Rayleigh Waves in a Two-Layer Model of the Earth's Crust," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 1, pp. 14-16.

VESIAC No. 1320 This report is a theoretical investigation of the dispersion of Rayleigh waves in a two-layer model of the earth's crust for an arbitrary thickness relation between granite and basalt. It makes a preliminary comparison of the computations with published experimental data.

KELLER, G. V., A Program of Research on the Electrical Properties of the Earth's Crust, with Emphasis on the Detection of Underground Nuclear Explosions, ARPA Order No. 193-61, U. S. Geol. Survey, Denver, Colo., 1961.

VESIAC No. 977 VU Four separate studies have been undertaken: (1) monitoring electromagnetic signals from the current test series; (2) compiling data on near-surface resistivities from electrical well logs; (3) studying earth resistivities at depths of 5 to 50 miles, with large-scale resistivity soundings and magnetotelluric measurements; and (4) observing telluric voltage levels and their relations with local geology.

There are two types of a nuclear explosion: a unidirectional transient voltage starting at the shot instant and persisting from 10 to 15 msec; and a series of oscillations occurring at a rate of one or two per second, starting about 2 seconds after the shot instant and persisting about a minute. The prompt signal is identified as electromagnetic; the delayed oscillations, as electroseismic. Prompt signals of definite explosive origin have been detected only within a few miles of ground zero (12.4 miles and less).

Tables of the electrical properties of rocks are being compiled for use in studying the effect of electrical properties of the earth along the transmission path of the signal generated by the nuclear explosion.

The resistivity of the deep crust may be high enough that electromagnetic waves can propagate through it with negligible attenuation; if so, nuclear tests deep in the earth might generate electromagnetic signals which would propagate through the deep crust. Since very little information is available on the electrical properties of this crust, a series of deep electrical probes to obtain this information has been started.

A program of telluric current studies has been begun to provide a reconnaissance method of locating areas where deep electrical surveys will be most worthwhile, and to evaluate the effect of local geological structure on telluric noise levels at sites which might be used in a nuclear test monitoring system. A seismograph site near Denver has been ruled out. A field technique used in the preliminary survey is the simultaneous recording of telluric potentials at a reference station and at a roving field station.

KEYES, R. T. See Collins, T. K.

KHAIKOVICH, I. M., and L. A. KHALFIN, "Effective Dynamic Parameters of Elastic Media for the Propagation of Plane Transverse Polarized Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 6, pp. 579-584.

VESIAC No. 1375 The article discusses a solution to the problem of the passage of a plane transverse polarized wave through a two-component medium with one component dispersed regularly through the other. Expressions are obtained for the effective velocity of the transverse wave and for the effective density. For certain conditions of the medium, exponential absorption and dispersion regimes are established.

KHAIRITDINOV, R. K. See Bulashevich, Yu. P.

KHALEVIN, N. I., "On the Impulse-Interval Acoustical Logging," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 3, pp. 211-215.

VESIAC No. 1264 Seismic investigations of wells are commonly used in reconnaissance. Methods applied at present by industrial organizations provide adequate accuracy in determinations of average velocity, but do not allow a detailed analysis of the well section in relation to its elastic properties. Knowledge of these elastic properties not only facilitates the interpretation of results from seismic reconnaissance, but also can raise the efficiency of the logging. In particular, when satisfactory and detailed differentiation of the sections according to their elastic properties will be more complete than at present, some light will be thrown on the following questions: determination of distances between the reflecting and refracting interfaces; properties of refracted and reflected waves from different interfaces; clearer outlining of differences in the porosity of formations than present methods allow, etc. The possibility and necessity for more detailed analyses of the well sections with respect to their elastic properties has been outlined in two previous papers. However, for a long time it was not possible to develop any wider variety of forms of geophysical well investigations,

because no suitable apparatus had been developed. An apparatus now under development and experimentation will permit the differentiation of well sections by means of ultra accoustics.

In 1953, we carried out comparatively limited measurements in wells, using a sounding method consisting of an impulsive electromagnetic source of elastic waves and a seismic receiver. placed at fixed distances from each other. Regardless of the low frequency of the receiver and of the fact that only a low-pass filter amplifier was available, and despite the low intensity of setting, the results have been encouraging. In particular, we have established a marked relationship between the intensity of the elastic waves and the lithology and structure of the section.

This article also contains a short description of the apparatus which we used in impulse-acoustical logging, as well as some experimental results.

KHALFIN, L. A. See Khaikovich, I. M.

KHANUTINA, R. V. See Riznichenko, Yu. V.

KHAYKOVICH, I. M., and L. A. KHALFIN, "On the Effective Dynamic Parameters of Non-Homogeneous Elastic Media During the Propagation of a Plane Longitudinal Wave," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 4, pp. 351-356.

VESIAC No. 1349 The report investigates the problem of the effective dynamic parameters of nonhomogeneous media during the propagation of seismic signals. The study was carried out on models of a well-regulated, two-component medium for longitudinal plane waves. The general expressions obtained for the effective parameters show that the nonhomogeneous medium is absorptive and dispersive.

KHOROSHEVA, V. V., "Some Results of the Investigation of P_a and S_a Waves from the Seismograms of Stations of the USSR," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 11, pp. 1045-1049.

VESIAC No. 1523 Using the seismograms of USSR stations, we have investigated P_a and S_a waves, whose origin is related by some authors to a layer with lower velocity in the upper portion of the Earth's mantle. We obtained the travel-time curves of the P_a and S_a waves, the approximate value of the geometric-divergence index, and the absorption coefficient of the P_a wave.

KHUDZINSKI, L. L., "On the Determination of Parameters of Layers of Intermediate Thickness from the Spectra of Reflected Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 5, pp. 439-444.

VESIAC No. 1568 The paper suggests a method for determining the thickness of a layer (with a known wave velocity) or of the propagation velocity of waves within it (with the thickness known) from the spectra of the

waves reflected from it. The paper discusses areas of applying the method and evaluates errors caused by the effect of the spectra of the shot, the absorption and frequency characteristics of the recording channel, and the presence of the interference background.

KHUDZINSKII, L. L., and A. YA. MELAMUD, "Frequency Analyser for Seismic Vibrations," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 9, pp. 24-45.

VESIAC No. 1704 This report describes a frequency analyzer for seismic vibrations which records the spectrum automatically under field conditions. The report includes some results of the analysis of seismic waves carried out with this apparatus.

KIHLSTROM, B. See Langfors, U.

KIRNOS, D. P. See Arkhangel'sky, V. T.

KISSLINGER, C., "Fourier Analysis of a Blast Record," Trans. Am. Geophys. Union, 1948, Vol. 29, No. 1, pp. 36-37.

VESIAC No. 1851 This paper reports the Fourier analysis of a seismogram of a dynamite blast; the blast was recorded by a Taylor-Macelwane seismograph. The report calculates six harmonics for 26 sections of the record and discusses the errors inherent in such an analysis.

KISSLINGER, C., "Motion at an Explosive Source as Deduced from Surface Waves," Earthquake Notes, 1960, Vol. 31, pp. 5-17.

VESIAC No. 1850 From the Rayleigh waves recorded at two distances, this paper deduces the history of events occurring near the source following a small explosion. Sato's Fourier analysis method and Lamb's solution for the displacement on a half space have been employed in two distinct approaches to this problem. The displacement history from the first approach shows an essentially rectilinear vibration of the earth particle after the initial compression. The second technique shows the vertical point force equivalent to the explosion. The vertical acceleration at the source from the first method agrees fairly well in general form with the force found in the second.

Information about the phase velocities and the initial phases of the constituent frequency components is a valuable by-product of the Fourier analysis technique.

KISSLINGER, C., "Seismic Waves Generated by Chemical Explosions," Semi-Ann. Tech. Rept. No. 2, Contr. No. AF 19(604)-7402, St. Louis Univ., St. Louis, Mo., 1962.

VESIAC No. 891 VU In August, 1961, a 100-ton charge of TNT was detonated in Alberta at the Suffield Experimental Station. A team from St. Louis University which took seismic measurements at this blast found no

very surprising results. Among some things of interest, however, was the presence of refracted SH waves, about 1/4 as large as the corresponding P waves. The SH waves add evidence that SH motion must be expected as a normal result of an explosion in or on the earth.

Although an excellent record of the GNOME nuclear explosion was obtained, it is not discussed in this report.

The report presents detailed observation of the motion generated in limestone by an explosion at a free face. It also notes the effect on seismic motion of the properties of the medium in which an explosion is detonated.

The report concludes that an increase in the rigidity of the medium causes a decrease in the maximum amplitude of the ground motion, that the ratio of P-wave to Rayleigh-wave amplitude is greater in a more rigid medium, and that the azimuthal distribution of P- and Rayleigh-wave amplitudes is very uniform (circularly symmetrical) for unconsolidated materials and non-uniform for hard rock. An abbreviated bibliography of significant papers concerned with the effects of the medium on explosion-generated waves is appended.

Note: Tracings of seismograms referred to in this paper have been published by the Suffield (Alberta) Experimental Station as Trial Record 435, Suffield Seismic Studies No. 5: "Seismograms Obtained Near the 1961 Surface Burst Charge of 200,000 Pounds TNT," by G. H. S. Jones, C. Kisslinger, and S. A. Cyganik. Preliminary results furnished to the Defense Atomic Support Agency immediately after the trial are published in DASA-1249, "United States Participation in 1961 Canadian 100-Ton High-Explosive Test (U)," 1 September 1961, (CONFIDENTIAL).

KLUGMANN, I. YU., and B. L. LERNER, "The Programing of Kinematic Corrections in a Machine for the Automatic Calculation of Profiles from Results of Seismic Surveys," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 10, pp. 978-982.

VESIAC No. 1612 This report investigates the calculations performed by machines for automatically constructing profiles from seismological data obtained from reflected waves. It discusses two different types of machine and indicates their ranges of application.

The report also discusses programing machine operation for regions of predominantly sloping structures and proposes a simplified rule for programing that would ensure their necessary accuracy of operation.

KNOPOFF, L., and F. GILBERT, "First Motion from Seismic Sources," Bull. Seis. Soc. Am., 1960, Vol. 50, No. 1, pp. 117-134

VESIAC No. 1901 An application of dynamic dislocation theory gives the elastodynamic radiation resulting from a sudden earthquake due to faulting. The fault plane is visualized as a geometrical discontinuity across which exists a sudden discontinuity in either one component of the strain tensor or one component of the displacement vector. The re-

port shows that there are eight independent models, if unilateral faulting is assumed; and it presents an argument to demonstrate the likelihood that unilateral faulting does not exist in nature. For bilateral faulting the eight independent models are reduced in number to five. Of these five, two are more likely to occur in nature than the others. One of these, the displacement dislocation model, has a first-motion radiation pattern formally identical with that of a double couple in an unfaulted medium. The second, the shear-strain dislocation model, has a first-motion radiation pattern formally identical with that of an isolated force in an unfaulted medium. The latter type of mechanism may occur in deep-focus earthquakes. Another type of radiation, corresponding to the single couple in an unfaulted medium, results from the sudden release of shear strain in a laminar region.

KNOPOFF, L., and F. GILBERT, "First Motion Methods in Theoretical Seismology," J. Acous. Soc. Am., 1959, Vol. 31, No. 9, pp. 1161-1168.

VESIAC No. 1944 This article presents techniques for approximating integral solutions to some problems in theoretical seismology. The approximations are the first terms of asymptotic series in powers of $t-t_0$, where t is the time and t_0 is an arrival time. The approximations are obtained by evaluating the integral form of the LaPlace transform of the time solution by the saddle point method or a variation of it. A Tauberian limit theorem applied to the resulting expression obtains the time solution. Two examples illustrate some of the specific techniques for using the method.

KNOPOFF, L., and F. GILBERT, "Radiation from a Strike-slip Fault," Bull. Seis. Soc. Am., 1959, Vol. 49, No. 2, pp. 163-178.

VESIAC No. 1894 Huygens' principle for elastodynamics has been applied to the problem of radiation resulting from the introduction of a tear fault of finite length into an otherwise homogeneous medium. The fault has the following properties. (1) It is a surface across which the normal stresses vanish. (2) It has a rectangular shape with one dimension increasing at a constant rate in the direction of faulting. (3) The times of initiation and termination of the fault are both finite. The relative displacement on opposite sides of the fault is prescribed to be a step function of time. This configuration may be imaged in the earth's surface by symmetry, so that the problem is reducible to that of a propagating strike-slip fault of finite length in an infinite elastic medium. The observed events are the P and S waves from the two ends of the fault. Simplified "first motion" responses are computed and compared with solutions derived from the usual theory of force couples.

KOGAN, S. D., I. P. PASSECHNIK, and D. D. SULTANOV, "Seismic Observations in Antarctica," Bull. Acad. Sci. USSR, Geophys. Ser., 1961. No. 2, pp. 147-149.

VESIAC No. 1549 This paper presents the results of seismic observations from the Soviet seismic stations in Antarctica (Mirnyi and Oazis) from June 1956 to December 1959. It compares the earthquake epicenter dis-

tribution with the geologic structure of the Subantarctic. From the dispersion curves of Love and Rayleigh waves the conclusion is that the earth's crust is of continental type in Eastern Antarctica and of oceanic type in the area that extends from Antarctica to the belt of Alpine-type fold structures encircling the polar continent.

KOGAN, S. YA., "Determining the Absorption Coefficient of Seismic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 12, pp. 1130-1135.

VESIAC No. 1617 The report investigates variation of a seismic pulse due to absorption, described by the law $a = k|w|^n$, with arbitrary values of k and n. It obtains asymptotic formulas permitting determination of the absorption parameters k and n.

KONDORSKAYA, N. V., "Regional Peculiarities in the Travel Times of Seismic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 7, pp. 67-86.

VESIAC No. 1693 Observations of strong earthquakes in the Far East (Kamchatka and the south-east of Hokkaido Island), Central Asia, and Turkey, have revealed that travel times of seismic waves to stations in the Far East, Central Asia, and the Caucasus are greater than the times determined by hodograph. The hodographs have been corrected by statistical averaging. These corrections make it possible to determine the position of epicentres with greater accuracy.

KONDORSKAYA, N. V., and G. A. POSTOLENKO, "Analysis of Observations on Earthquakes in the Kurilo-Kamchatka Region," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 10, pp. 1033-1037.

VESIAC No. 1421 From an analysis of earthquake observations in the Kurilo-Kamchatka region the authors assign the epicenters to individual zones whose boundaries coincide in the Kurile Islands region with the azes of tectonic troughs and transverse fault lines. They describe the characteristics of each epicentral zone and discuss the distribution of the earthquakes according to depth.

KONDORSKAYA, N. V. See Belotelov, V. L.

KONDRAT'EV, O. K. See Sorokhtin, O. G.

KONSTANTINOVA, A. G., "Time Distribution of Elastic-Pulse Energy During Destruction of Rocks," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 11, pp. 1056-1061.

VESIAC No. 1525 Analysis of the time distribution of elastic-pulse energy reveals certain aspects of the fracturing process during destruction of rock specimens under mono-axial compression and in coal seams during sudden discharges of coal and gas.

KORIDALIN, E. A., "Seismology in the Chinese People's Republic," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 1, pp. 1-8.

VESIAC No. 1659 This report surveys the trends in seismological studies conducted by the Geophysical Institute of the Academy of Sciences in the Chinese People's Republic.

KORIDALIN, E. A., "Some Characteristics of L_g and R_g Waves and Regional Features in Their Propagation," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 8, pp. 733-737.

VESIAC No. 1594 This report is a study of the general features of L_i, $Lg1$, $Lg2$, and R_g waves from seismograms of the Moscow Seismic Station in conjunction with earthquake traces from other stations. It determines the mean periods in relation to the epicentral distances and the group velocities. It also notes features of the nature and propagation of waves dependent on the structure of the earth's crust, and the foci of the earthquakes.

KORMER, S. B. See Altschuler, L. V.

KOROLEVA, V. A. See Petrova, G. N.

KOSMINSKAYA, I. P., G. G. MIKHOTA, and YU. V. TULINA, "Crustal Structure of the Pamir-Alai Zone from Seismic Depth-Sounding Data," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 10, pp. 673-683.

VESIAC No. 1301 The paper gives the results of seismic depth-sounding (SDS) in the crustal structure in the Pamir-Alai zone. It identifies two seismic boundaries corresponding to the "basaltic" and Mohorovicic surfaces. The first varied in depth from 15 to 40 km and the second from 45 to 70 km. It shows that the negative anomalies of -220 to -450 milligals, Bouguer correction, observed in this region and the greatest in the USSR, can be accounted for by the relief of the deep boundaries.

KOSMINSKAYA, I. P. and R. M. KRAKSHINA, "On Reflections Beyond the Critical Angle from the Mohorovicic Discontinuity," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 6, pp. 537-544.

VESIAC No. 1579 The article describes kinematic and dynamic peculiarities of waves reflected beyond the critical angle from the Mohorovicic discontinuity; these were recorded in the northern part of the Sea of Okhotsk with a continental type of the earth's structure. In regions with the oceanic type of crust structure, no reflections beyond the critical angle were isolated.

KOSMINSKAYA, I. P., and YU. V. TULINA, "An Experimental Application of the Seismic Depth-Sounding Method to the Investigation of the Structure of the Earth's Crust in Parts of Western Turkmenia," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 7, pp. 38-66.

VESIAC No. 1692 The following paper shows the results of seismic depth soundings (SDS) taken in certain regions of Western Turkmenia for the purpose of investigating the structure of the earth's crust. It describes the features peculiar to the seismic boundaries situated at depths corresponding to the surfaces of the palaeozoic, granitic, basaltic and subcrustal layers. Charts show the palaeozoic surfaces and thicknesses of the crust. The maximum crustal capacity, in the Caspian depression, is over 40 km and the minimum, in the Bol'shoi Balkhan, under 30 km. The crustal sections were compared with the focal depths of weak earthquakes recorded at high-sensitivity RWCM stations (Refracted Wave Correlation Method).

KOVACH, R. L., "Surface-Wave Dispersion for an Asio-African and a Eurasian Path," J. Geophys. Res., 1959, Vol. 64, No. 7, pp. 805-813.

VESIAC No. 1873 Love and Rayleigh waves ranging from 20 to 83 seconds were well recorded at Lwiro, Belgian Congo, from an Aleutian shock on March 20, 1958. The epicentral distance was 14,240 km (128°) and the direct path was almost entirely continental. The path through the antipodes was almost entirely oceanic, and the corresponding Rayleigh waves were recorded at Lwiro and at Pietermaritzburg, South Africa. Dispersion data indicate an average crustal thickness of slightly less than 40 km for the continental path and a mean sediment thickness of 0.8 km for the oceanic path.

Uppsala seismograms of the Sinkiang shock of June 24, 1958, exhibited fundamental and higher-mode Love waves, Rayleigh waves affected by the near-surface sediments, and higher-mode Rayleigh or M_2 waves. An average crustal thickness of about 45 km is indicated for the path studied. This result agrees well with available Russian refraction measurements.

KOVALEV, O. I., and L. V. MOLOTOVA, "Borehole Percussion Device for the Excitation of Various Types of Elastic Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 7, pp. 639-646.

VESIAC No. 1495 This paper discusses the construction of a percussion borehole device whose effect is analogous to that of a horizontal force applied in a given direction; and it discusses results of field tests of the borehole percussion device. It also gives data on velocities of longitudinal and transverse waves SV and SH in sandy clay rocks composing the upper portion of the profile (0 to 30 m).

KOVALEV, O. I. See Vassil'yev, Yu. I.

KRAKSHINA, R. M. See Kosminskaya, I. P.

KRAMER, M. V. See Pertsev, B. P.

KRESTNIKOV, V. N. See Gzovsky, M. V.

KUHN, V. V., "The Peculiarities of Seismic Waves in Media with Pinching-Out Layers (from Model Investigation)," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 12, pp. 1136-1147.

VESIAC No. 1618 The author has investigated the dependence of the relative intensity of head waves (longitudinal and converted) and diffracted waves originating in media with pinching-out layers on velocities and densities in the media, the angle of pinching out, and the depth of the pinching-out layer.

The report includes some approximate theoretical calculations of the relative intensity of the waves, as well as a comparison of the results of the calculations to the modeling data.

LAKE, H. R., and G. T. BAKER, Statistical Determination of Power Density Spectra from Minimal Information, Part II, Rept. No. 116-57-005-02A, Texas Instruments, Inc., Dallas, Tex., 1962.

VESIAC No. 1765 This is a final technical report on the Statistical Noise Analysis Program, which was directed toward determining efficient, practical methods for obtaining statistically meaningful estimates of power density spectra of seismic noise from a minimum of input information.

The last Quarterly Technical Report (SER 116-57-005-02) demonstrated that polarity data processing of data having a Gaussian amplitude distribution could yield exact power density spectra. No attempt was made at that time to investigate the minimum amount of data needed to obtain stable spectral estimates.

The time duration of polarity data needed to produce acceptable spectral estimates has been studied; results are presented in this report. In addition, a small amount of work has been devoted to analysis of earthquake signals by polarity data processing.

LANDISMAN, M. See Ewing, M.

LANGE, A. L. See Wells, W. M.

LANGEFORS, U., H. WESTERBERG, and B. KIHLSTROM, "Ground Vibrations in Blasting," Water Power, 1958, pp. 335-443.

VESIAC No. 1817 This article deals with the measurement and character of ground vibrations caused by blasting, and recommends ways to reduce the intensity of the vibrations and avoid damage to structures or property.

LASTER, S. J. See Gilbert, F.

LATTER, A., "Decoupling of Underground Explosions," Proj. VELA, Proc. of Symposium, Advanced Research Projects Agency, Washington, D. C., pp. 177-186, 1960.

VESIAC No. 734-K
AD 253 702

This report discusses decoupling concepts of underground explosions in relation to the results obtained from Project COWBOY. The seismic signal is reduced by more than two orders of magnitude when a sufficiently large hole is used for the explosion and when the average explosion does not exceed the overburden pressure.

LAVIN, P. M., Model Studies of Seismic Energy Distribution Around Different Types of Source, Spec. Tech. Rept. No. 1, Contr. AF 19(604)-7383, Penn. State Univ., University Park, Pa., 1962.

VESIAC No. 1807 VU

First-motion patterns of P (compressional) and S (shear) waves have been suggested for identifying earthquake and explosion source mechanisms and distinguishing between them. This study concerns the effect of near-source inhomogeneities on the first-motion patterns of P and S around force systems simulating an explosion, unidirectional force, single couple and double couple. Conventional two-dimensional ultrasonic modelling techniques have been employed.

Patterns for the uniform models are generally consistent with theory except for weak S waves in the radial-force model. Reversals of the first motions of P and S resulting from velocity discontinuities have not been observed except for P within 30^{0} of the boundary running through the double-couple source. Amplitude reduction in the high-velocity medium of the nonuniform models leads to the possibility of missing the first motions.

"First-motion" patterns may thus be altered so as to be undependable for determining the source mechanism. Under certain conditions a single-couple, double-couple, and radial force produce a single-force distribution; the single force gives a single-couple pattern.

LAZAREVA, A. P. See Savarensky, E. F.

LEET, L. D., "The Detection of Underground Explosions," Sci. Am., 1962, Vol. 206, No. 6, pp. 55-59.

VESIAC No. 1799

The author poses three basic questions: (1) Can a reasonable network of seismographic stations detect and locate underground explosions having an energy of a few kilotons? (2) Can such a network differentiate explosions from earthquakes? (3) Can such a network do these things with a high degree of reliability? The article presents illustrations and discussions of seismic recordings of underground dynamite and nuclear explosions and earthquakes, and compares the various wave characteristics according to distances and other parameters.

As a result of this analysis, the author thinks that a network such as the once-proposed Geneva network would be adequate for the detection criteria which these comparisons suggest. It is possible that Project VELA has developed information bearing on this matter; however, at present the suggestion is strong that earthquake and nuclear explosions waves can be distinguished.

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LEET, L. D., "Earth Motion from the Atomic Bomb Test," Am. Sci., 1946, Vol. 34, No. 2, pp. 198-211.

VESIAC No. 888 Conditions at the atomic bomb test in New Mexico on July 16, 1945, duplicated experimentally for the first time at a proper energy level the problem of Lamb in 1904. Lamb had solved equations of elasticity to predict ground motion at a place distant from a point at which a vertical impact is applied to the ground.

Ground motion was recorded on a damped three-element seismograph with oriented horizontal components. Results differed widely and significantly from prediction. One previously-reported wave type, the coupled wave, not predicted by theory, carried an appreciable portion of the energy in the ground waves. Another, the hydrodynamic wave, had not been reported or predicted before; it produced the greatest displacements on the record. Longitudinal, transverse body, Rayleigh, and surface shear waves were also identified.

This record represents the most important single advance to date toward solving the basic seismological problem of establishing observationally the types of waves which earth materials in place will support.

LEET, L. D., "Mechanics of Earthquakes Where There Is No Surface Faulting," Bull. Seis. Soc. Am., 1942, Vol. 32, No. 2, pp. 93-96.

VESIAC No. 794-D This article offers a hypothesis to explain the New Hampshire earthquakes of December 1940. It cites previous work regarding the mechanism of earthquakes and considers the crustal structure of the area.

LEET, L. D., and D. J. LINEHAN, "Instrumental Study of the New Hampshire Earthquakes of December, 1940," Bull. Seis. Soc. Am., 1942, Vol. 32, No. 2, pp. 75-82.

VESIAC No. 794-B This article locates the epicenter about one mile west of Whittier, N. H., at 43^{o} 50' N, 71^{o} 17' W and reports that S started from a depth of about 35 km and P from a depth of 15 km. Both shocks were potentially destructive and were felt as far as 350 miles.

LEET, L. D., D. LINEHAN, and P. R. BERGER, "Investigation of the T Phase," Bull. Seis. Soc. Am., 1951, Vol. 41, No. 2, pp. 123-141.

VESIAC No. 787 Study of 250 earthquakes shows that the T phase ranges in period from 0.5 to 1.0 seconds. It is generated under the ocean (in areas ranging down to 3000 fathoms) by earthquakes not necessarily of shallow foci (mostly between 40 and 100 km in depth). The velocity is between 1.6 and 2.7 km/sec over ocean paths and 2.1 km/sec over land. (The velocity of sound in water of the Atlantic is from 1.46 to 1.53 km/sec.) Waves in different parts of the T phase have a progressively changing angle of approach. The T phase may be short-period shear waves traveling in ocean-bottom sediments and the top continental layer, but definitely is not water-borne.

Ewing, Press, and Tolstoy reported in 1949 ("The T Phase of Shallow-Focus Submarine Earthquakes" and "Proposed Tsunami Warning System") that the T phase has periods of 0.5 second or less, and has the velocity of sound in water for that part of its path across deep water and velocities from 3.7 to 5.5 km/sec across shallow water or land. They believe that propagation through the sound channel accounts for the major part of the T phase. These conclusions, however, are invalidated by misreadings and miscalculations.

LEET, L. D. See Linehan, D.

LEITH, E. N. See Cutrona, L. J.

LERNER, B. L. See Klugmann, I. Yu.

LEVIN, B. YU., and S. V. MAEVA, "Thermal History of the Earth," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 2, pp. 163-169.

VESIAC No. 1474 This paper presents computations on the thermal history of an originally cold Earth for a series of models of the Earth which differed by the mean amount of its radioactive elements, the heat capacity of its interior and the influence of radiant thermal conductivity. The development of the earth's crust is a lengthy process which began 3×10^9 years ago. Radiant thermal conductivity exerts a considerable influence on the computed heat flow which agrees with the observed heat flow containing fewer radioactive elements than was previously assumed. Comparison of theoretical values of heat flows for the earth's areas between the continental and oceanic crusts showed that the difference in heat flow is less than the differences in the thickness of the crust; for heat radiates not only from the crust, but also from deeper layers. This conclusion agrees with the fact that observations do not establish noticeable systematic differences in the heat flows between the continents and oceans.

LEVITSKAYA, A. YA., and M. V. MURATOV, "The Relationships of Seismicity and Tectonic Structure in the Black Sea Depression and Adjacent Areas," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 4, pp. 360-375.

VESIAC No. 1352 This report describes the seismicity ot the Balck Sea depression and adjacent areas. It discusses the relationship of the seismicity to the tectonic structure. A seismotectonic map shows the relationship of epicenter distribution to intensity, focal depth and accuracy of determination.

LEVSHIN, A. L., "Determination of Ground Water Level by the Seismic Methods," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 9, pp. 857-870.

VESIAC No. 1601 This paper investigates the physical premises of applying seismic methods of prospecting for the determination of ground water level in

unconsolidated deposits. It presents an analysis of some experimental seismic data obtained under various geological and hydrogeological conditions and discusses the question of the existence of criteria for recognizing the boundary related to the water level among other seismic boundaries.

LIBRARY SERVICES SECTION (Staff), Soviet Seismology and Seismometry — A Preliminary Bibliography, AID Rept. No. 61-135, Library Services Division, Air Info. Div., 1961.

VESIAC No. 982
AD 265 437

This preliminary bibliography on seismology and seismometry is published for purposes of current research and is primarily limited to 1958 to 60.

This bibliography is not comprehensive, but may serve as a guide to the growing volume of Soviet seismological literature. For convenience the listing of entries is divided into 13 main subject headings with appropriate subheadings.

Library of Congress call numbers are included at the end of the entries when the source is cataloged and available in LC collections.

LIEBER, P., K. T. YEN, and H. C. MATTICE, Studies on the Propagation of Seismic Waves in Visco-Elastic Media, RPIAL No. 102, Rens. Poly. Inst., Troy, N. Y., 1952.

VESIAC No. 1020
AD 8 181

This report evaluates the effect of viscosity and plasticity upon the propagation of seismic waves. A study has continued on the propagation of Love waves in a half-infinite space consisting of a layer of Sezawa material resting on a semi-infinite layer of a Maxwell material. A procedure for estimating the spatial attenuation of Love waves attributed to the viscosity of these materials has been developed.

The report also presents a theory for the propagation of Rayleigh waves in a Maxwell material. The propagation speed of these waves leads to a dispersion phenomenon not obtained with a perfectly elastic material. Also, the viscous properties of the Maxwell material affect the speed of propagation and the attenuation of these waves. As a step toward predicting the propagation of seismic waves originating from a well-defined source imbedded in a layered and bounded visco-elastic medium, the report presents a theory for calculating the propagation of a simple harmonic disturbance generated at the surface of a finite spherical cavity imbedded in a homogeneous and unbounded Sezawa material.

LINEHAN, D., and L. D. LEET, "Earthquakes of the Northeastern United States and Eastern Canada, 1938, 1939, 1940," Bull. Seis. Soc. Am., 1942, Vol. 32, No. 1, pp. 11-17.

VESIAC No. 786

This report continues the work of Leet in cataloging earthquakes. Seismicity indicated agrees remarkably with Heck, differences being accounted for by population shifts and development of instruments. Activity appears to be increasing. Comparison with Heck of severe

shocks that would certainly have been felt and recorded indicates an interval of 75 to 100 years between such shocks in the past; but in the last 75 years that interval has dropped to 30, 10, and 5 years.

LINEHAN, D. J. See Leet, L. D.

LIVINGSTON, C. W., Application of the Livingston Crater Theory to Blasts in Loess and Clay, U. S. Army Eng. Waterways Exp. Sta., Corps of Engs., Vicksburg, Miss., 1960.

VESIAC No. 1936
AD 234 078

This study applies the Livingston crater theory to 0.125-, 0.5-, 1.0-, and 8.0-lb blasts of C-4 in loess and clay using data contained in Technical Report No. 2-482, published in June 1958 by the U. S. Army Engineer Waterways Experiment Station (WES). It discusses conventional cube-root scaling ($W^{1/3}$) and gives evidence to support the theory upon which the crater equations are based.

The equations and the theory bear upon the model laws for explosions; variation in the behavior of the material as the scale of the experiment is increased; ranges of similar behavior in cratering; variables in cratering; damage limits; energy partitioning to the material and to the atmosphere; the mechanics of failure in cratering; and the dependence of all parameters upon the depth ratio, which is a measure of the ratio of the mass of the material to the energy of the explosion.

LOCK, M. H. See Hook, J. F.

LOMBARD, D. B., and D. V. POWER, Close-In Shock Studies, Preliminary Report, Rept. No. PNE-104P, Lawrence Rad. Lab., Livermore, Calif., 1962.

VESIAC No. 1777

Measurements of shock parameters, including particle-velocity profile and peak shock pressure, were attempted in the salt close-in to the GNOME nuclear explosion. The measurements were to be compared with results predicted by the UNEC code. Radiation-fogged film and damaged instruments nullified most of the measurements, but the experience will be valuable in designing instruments and techniques for similar experiments in the future.

LONGUET-HIGGINS, M. S., "Phase Velocity Effects in Tertiary Wave Interactions," J. Fluid Mech., 1962, Vol. 12, Pt. 3, pp. 333-336.

VESIAC No. 1206

When two trains of waves interact in deep water, the phase velocity of each is modified by the presence of the other. The change in phase velocity is of second order and is distinct from the increase predicted by Stokes for a single wave train. When the wave trains are moving in the same direction, the increase in velocity Δc_2 of the wave with amplitude a_2, wave-number, k_2 and frequency σ_2 resulting from the interaction with the wave a_1, k_1, σ_1 is given by $\Delta c_2 = a_1{}^2 k_1 \sigma_1$, provided that $k_1 < k_2$. If $k_1 > k_2$, then Δc_2 is given by the same ex-

pression multiplied by $k_2|k_1$. If the directions of propagation are opposed, the phase velocities are decreased by the same amount. These expressions are extended to give the increase (or decrease) in velocity due to a continuous spectrum of waves all travelling in the same (or opposite) direction.

LONGUET-HIGGINS, M. S., "Resonant Interactions Between Two Trains of Gravity Waves," J. Fluid Mech., 1962, Vol. 12, Pt. 3, pp. 321-322.

VESIAC No. 1205 In a 1960 paper Phillips showed that two or three trains of gravity waves may interact to produce a fourth (tertiary) wave whose wave number is different from any of the three primary wave numbers k_1, k_2, k_3, and whose amplitude grows in time. Such resonant interactions may produce an appreciable modification of the spectrum of ocean waves within a few hours. By a slightly different method this paper calculates in detail the interaction for the simplest possible case: when two of the three primary wave-numbers are equal ($k_3 = k_1$).

When k_1 and k_2 are parallel or antiparallel, the interaction vanishes unless $k_1 = k_2$. Generally, if θ denotes the angle between k_1 and k_2, the rate of growth of the tertiary wave with time is a maximum when $\theta \doteqdot 17^{\circ}$; the rate of growth with horizontal distance is a maximum when $\theta \doteqdot 24^{\circ}$. The calculations show that it should be possible to detect the tertiary wave in the laboratory.

LOSSOVSKI, E. K., "Pecularities of Amplitude-Graphs of Plane Elastic Waves in a Layered Medium," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 12, pp. 1161-1164.

VESIAC No. 1620 The paper discusses the behavior of reciprocal amplitude graphs of plane waves in a two-layered medium at a normal incidence of the waves at the interface. It shows that, if the strength of the emission in reciprocal points is the same, the principle of reciprocity for the magnitude of the displacement and the pressure does not hold.

LOZINSKAYA, A. M., "The String Gravimeter for the Measurement of the Gravity at Sea," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 3, pp. 272-278.

VESIAC No. 1343 This article describes the principle and method of constructing a working model of a string gravimeter with automatic recording of the frequency of vibration of the string. This model was designed in the All-Union Institute of Scientific Research in Geophysical Methods of Prospecting of the Ministry of Geology and the Conservation of Mineral Resources for gravimetric surveys at sea.

LUSTIG, E. N., "Convection in the Earth's Mantle," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 1-2.

VESIAC No. 1458 Less than 6% of the total output of the heat sources responsible for convection can be transmitted to the earth's crust; that is, not

more than 10^{26} erg/year. According to seismic data, this does not contradict an estimation of the output of tectonic processes.

LUSTIG, E. N., "The Energy Consumed in the Formation of the Earth's Crust," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 3, pp. 269-273.

VESIAC No. 1480 In the process of the crust's formation by the differentiation of the Earth's mantle, energy of an average order of 10^{26} erg/year is released. If our evaluation of the energy of tectonic processes—computed on the basis of the energy of seismic waves—is correct, then, under certain conditions the amount of released energy may be sufficient for sustaining these processes. From this viewpoint the most logical scheme would be one based on the assumption that sial rises from the mantle along a planetary fracture.

LUSTIG, E. N., "On the Hypothesis of Thalassogenesis and on the Movement of Blocks in the Earth's Crust," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1096-1101.

VESIAC No. 1428 Any hypothesis assuming an expansion of oceans because of the erosion of continents is untenable. The facts presented to defend such a hypothesis admit different explanations, too. The mobility of the junctures between blocks of the continental crust does not prove that the blocks themselves are mobile.

LYUSTIKH, E. N., "Convection in the Earth's Envelope According to the Calculations of Pekeris," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 5, pp. 63-75.

VESIAC No. 1683 This critical discussion of the convection patterns which Pekeris calculated to explain geotechtonic processes concludes that a world gravimetric survey provides no support for the convection hypothesis.

MAC DONALD, J. F. See Gilbert, F.

MAENCHEN, G., and J. NUCKOLLS, "Calculations of Underground Explosions," in Proc. Geophys. Lab. Cratering Symposium, Part II, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1146-J The described calculations are an attempt to predict underground explosion phenomena from physical conservation laws and laboratory measurements of the properties of the materials. Analytic solutions for nontrivial cases are usually impossible to obtain because of the nonlinear behavior caused by the simultaneous existence of and dynamic transitions between gaseous, liquid, plastic, fractured, and elastic states. We have therefore chosen to integrate the equations numerically on a digital computer. In the two "codes" developed for this purpose the calculation is simplified by restricting the problem to spherical or cylindrical symmetry. Inelastic effects like plasticity and fracture are treated by imposing simple restrictions on the stress tensor.

MAEVA, S. V. See Levin, B. Yu.

MAGNITSKY, V. A. and V. A. KALININ, "The Properties of the Earth's Mantle and the Physical Nature of the Transition Layer," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 1, pp. 49-54.

VESIAC No. 1322 The authors investigate the possibility of explaining the properties of the C-layer by assuming a transition from a predominantly ionic bond in the upper part of the mantle to a predominantly covalent bond in deeper layers. They adopt no specific hypothesis regarding the chemical composition of the material of the mantle.

MALINOVSKAYA, L. N., "The Dynamic Features of Totally Reflected Transverse Waves, Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 2, pp. 106-110.

VESIAC No. 1254 This report investigates the influence of a free surface on the form, polarization, and relationship between the components of the displacement in a transverse wave (a direct wave or one experiencing on its way a sequence of reflections and refractions). It calculates the influence of a low-velocity surface layer on transverse waves when they strike the base of the layer at an angle larger than critical.

MALINOVSKAYA, L. N., "On the Dynamic Characteristics of Longitudinal Reflected Waves Beyond the Critical Angle," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 5, pp. 22-29.

VESIAC No. 1681 The article quotes theoretical seismograms of reflected longitudinal waves (including those for angles greater than critical) and analyses them for three- and four-layer media.

MARTEL, R. R. See Alford, J. L.

MASON, R. G., and M. J. VITOUSEK, "Some Geomagnetic Phenomena Associated with Nuclear Explosions," Nature, 1959, Vol. 184, No. 4688, pp. 52-54.

VESIAC No. 889 The three IGY stations operated in the central Pacific by the Scripps Institution recorded magnetic disturbances following, and apparently caused by, the various nuclear tests conducted by the British in the vicinity of Christmas Island. The article presents magnetograms for Z, D, and H for the British nuclear explosion of April 28, 1958. Perhaps the most striking feature of these is the absence of any observable disturbance in H corresponding to the major disturbance in Z and D. Results from a U. S. nuclear test in the ionosphere over Johnston Island on August 1, 1958, are compared with lower-altitude British tests; after the U. S. explosion changes in H comparable in magnitude with those in D and Z occurred. The article concludes that no simple explanation of these and related magnetic phenomena is expected, since several distinctly separate mechanisms are probably involved.

MATHEY, R., Y. ROCARD, and F. PERRIN, "Performances of Some Seismographs with Short Periods," Comptes rendus des seances de L'Academie des Sciences, 248, pp. 1-3.

VESIAC No. 1657 VU Five seismic recordings of explosions or of brief shocks from distances of 3.5 to 8550 km have been collected. The article discusses the possibility of recording small explosions at large distances.

MATHUR, S. P. See Howell, B. F.

MATTICE, H. C. See Lieber, P.

MATUMOTO, T. See Sato, Y.

MC LAMORE, V. R. See Forbes, C. B.

MC MANIS, L. B., "Proposed Standards for Seismic Amplifiers. . . and What They Mean to Field Records," Geophys., 1961, Vol. 26, No. 5, pp. 543-549.

VESIAC No. 927 Seismic amplifier performance may be categorized broadly into AGC action, filtering, and distortion (including noise). Eight specifications can define the characteristics of each as follows:

AGC:	1. Steady-state AGC, including "burst-out"
	2. AGC control vs. frequency
	3. Dynamic AGC action
	4. AGC distortion effects
Filtering:	5. Amplitude response
	6. Phase response
Noise and	7. Pre-filter distortion
Distortion:	8. Internal amplifier noise

These eight specifications allow a user to predict, and consequently allow for, amplifier action—both desirable and deleterious—in obtaining field records.

The author proposes that these specifications, coupled with the usual "external" specifications, be considered a starting point for establishing a standardized method of specifying seismic amplifier characteristics similar to the SEG "Standard Methods of Specifying Performance" for magnetic recording.

MEAD, J., Investigation of Possible Vertical Reflections from Deep Crustal Discontinuities, Final Rept., Dept. of Geology, Indiana Univ., Bloomington, Ind., 1956.

VESIAC No. 1187
AD 91 692 The report investigates the possibility of identifying vertical reflections from possible seismic discontinuities within and at the lower boundary of the earth's crust. Observations were made near 33 large quarry explosions from New England to the Middle West. Results indicated that the arrival of simultaneous bundles of seismic energy

on multichannel seismic recording apparatus near large explosions can not be definitely correlated with possible crustal structure, because of the large number of potential reflections observed throughout the duration of the recordings and the lack of definite correlation between separate series of observations. The amplitude of the ground motion during the first 5 minutes after a large explosion does not decay in amplitude with the expected exponential function after the effect of divergence is removed; the amplitude appears to decay inversely as a function of the square of the elapsed time.

MEECHAN, W. C., and J. DENOYER, "Azimuthal Asymmetry of a Point Source in a Cylindrical Low-Velocity Medium," Bull. Seis. Soc. Am., 1962, Vol. 52, No. 1, pp. 139-144.

VESIAC No. 899 The geometry of the medium near an otherwise symmetrical source produces a frequency-dependent variation of amplitude with azimuth. The model considered is a cylindrical low velocity and low density fluid medium contained in a full space of a higher velocity and density fluid material. A simple harmonic point source is located on the axis of the cylinder. Amplitudes in the higher velocity medium at large distances from the source are functions of the velocity and the density ratios of the two media, the radius of the cylinder, the wavelength, and the angle between the axis of the cylinder and a line connecting the point of observation with the source.

MEECHAN, W. C. See Denoyer, J.

MEISELS, M. W., "Design for Peace: Underground and Space Tests Create Urgent Need for Electronics in A-Bomb Detection," Electronic Design, 1960, pp. 38-47.

VESIAC No. 1144 This report outlines design requirements for equipment needed in VELA UNIFORM, SIERRA, and HOTEL programs. It discusses plans and equipment for detecting underground nuclear explosions and nuclear explosions in space. A heavy share of several billion dollars will be spent for seismometers and for data processing, telemetry, and recording equipment. The present state of electronics may support new applications of principles for seismic instruments. A new digital-output seismometer is needed; special computers, new from the ground up, will be required.

MEI-SHI-YUN, "The Seismic Activity of China," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 3, pp. 254-264.

VESIAC No. 1478 This report examines the seismic activity of China by instrumental observations and from historical data covering 3000 years. It cites maps of seismicity and examines seismic activity in separate zones. The report also shows relationships between the intensity and frequency of earthquakes and investigates the possibility of a periodicity in seismic activity.

MELAMUD, A. YA., "Transient Processes in Seismic Prospecting Apparatus," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 4, pp. 267-274.

VESIAC No. 1271 On the basis of an idealized resonance-receiving system and an idealized seismic pulse, the report examines operating characteristics of a seismic prospecting-receiving apparatus. It demonstrates that on receiving the seismic waves, the seismic prospecting apparatus functions under what is known as a pulsed (dynamic) regime, when the sensitivity, resolving power and filtering power depend on the duration of the signal (width of spectrum) at entry. The report determines the extent to which the frequency characteristics of the apparatus can be used for determining these parameters in a stationary regime.

MELTON, B. S. and L. F. BAILEY, "Multiple Signal Correlators," Geophys., 1957, Vol. 22, No. 3, pp. 565-588.

VESIAC No. 1832 This article discusses methods of correlating any number of input functions or signals to be compared. It shows that correlation values can be obtained from any one of several arithmetic processes which measure the degree of similarity of the inputs, and that these processes can be mechanized. Included are a simple addition, a sign-coincidence scheme, and two processes based on analysis of variance.

The discussion of analysis of variance procedures as applied to signals shows that the answers can be interpreted in terms of statistical significance, that measurements of coherent signal power can be made, and that the accuracy of such measurements is greatly improved as the number of input signals is increased. Signal-to-noise ratio is uniquely related to statistical significance, and signal detectability is plotted as a function of number of inputs and signal duration. The report suggests and illustrates several means of presenting data.

MEYER, R. P., J. S. STEINHART, G. P. WOOLLARD, and W. E. BONINI, "Refraction-Phase Correlation Techniques As Applied to the Preliminary Results in Eastern Montana," 1960, J. Geophys. Res., Vol. 65, No. 8, pp. 2511. (Abstract of Paper Presented at the Forty-First Annual Meeting, Am. Geophys. Union, Washington, D. C., April 27-30, 1960.)

VESIAC No. 1874 Continuous profiles from 100 to 250 km have been obtained as part of a 300-km reversed-seismic-refraction profile located in the northern Great Plains and the Powder River Basin extending north from Sheridan, Wyoming, to the vicinity of the Fort Peck Reservoir, Montana. The Bouguer anomalies average about -100 mgal. Principal phases are in general represented on all records as primary or secondary events. Secondary events not directly related to reflection and refraction events are present. Basis results for the highly detailed south-to-north line are entirely compatible with a north-to-south reconnaissance line completing the reverse.

Standardization of instruments (amplifiers, geophones, and paper speed) and water shooting have apparently contributed significantly to

the uniform character of records made at different times and on varying terrains. Apparent velocities computed for spreads of from 4500 to 6000 feet long are usually compatible with or indicate higher velocities than the gross travel-time velocity and are of real assistance in identifying arrivals.

Preliminary results indicate velocity-thickness relations as 1.76 km of 2.75 km/sec material, 1.6 km of 4.65 km/sec material, 23.63 km of 6.15 km/sec material, and 21.40 km of 7.37 km/sec material, with a Mohorovicic discontinuity represented by a velocity of 8.11 km/sec. The total crustal thickness is 48.4 km. All layers are flat lying. About 20 field days were required to record the 100 spreads comprising the reverse profile.

MEYER, R. P. See Steinhart, J. S.; Woollard, G. P.

MIFSUD, J. F. See Runyan, W. R.

MIKHAILOVA, N. G. See Epinat'eva, A. M.

MIKHOTA, G. G. See Kosminskaya, I. P.

MILLER, H. J. See Espinosa, A. F.

MILLIGAN, M. L., Small Scale Explosions in Nevada Soil-Surface Phenomena, Interim Rept. No. 13, U. S. Naval Ord. Lab., White Oak, Md., 1954.

VESIAC No. 1771
AD 52 317

This report summarizes the surface phenomena data obtained from film records of six 256-lb TNT explosions at the Nevada Proving Grounds. It gives measurements of the smoke crown, column, jet, radial throwout extent, and base surge are reported. The analysis is confined to the Project MOLE rounds which were fired on the surface and underground to a scaled depth of 1.0 ft/lb$^{1/3}$. The report briefly notes differences between the surface effects from the MOLE Nevada and Utah rounds.

MILNE, W. G. See Hodgson, J. H.

MISHIN, S. V. See Rykunov, L. N.

MISZ, J. B. See Thompson, T. L.

MIYAMOTO, M., "On the ScS Waves of Deep-Focus Earthquakes Observed Near the Epicenter and Their Application," Geophysics, 1933, Vol. 8, pp. 77-101.

VESIAC No. 1059

Transverse ScS waves reflected at the boundary of the earth's core appear distinctly on seismograms recorded near the epicenter of deep-focus earthquakes. Twenty-two deep-focus and two shallow-focus earthquakes were investigated. From seismic data on the best

observed earthquakes, epicentral locations and depth of focus were determined and time-distance curves were plotted.

Epicentral locations were determined from arrival times of P waves at several seismic stations. With the P-wave velocity in the crust taken as 7.65 km/sec, the focal depth was obtained in two ways: from the epicenter, or from the difference in arrival times of P and S waves translated to the epicenter. The ordinary sharp S wave (iS) was taken as the point of measurement, rather than the slowly beginning wave (eS) appearing 4 to 6 seconds earlier. Thus the velocity ratio of P to S was taken as 1.794.

From the calculated epicentral locations and focal depths, and from the observed arrival times between iS and P and between ScS and P, epicentral distances and focal depths of other earthquakes may be obtained. The earlier eS wave may be a longitudinal wave refracted at a crustal discontinuity.

MOKHOVA, E. N. See Kalashnikov, A. G.

MOLOTOVA, L. V., and YU. I. VASSIL'EV, "On the Value of the Ratio of the Velocities of Longitudinal and Transverse Waves in Rocks, I," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 7, pp. 621-630.

VESIAC No. 1494 The paper examines the existing methods of determining the ratio of the velocities of longitudinal and transverse waves in rocks and suggests several new methods for the determination of this parameter. It presents examples of the determination of vp/vs from field experimental data.

MOLOTOVA, L. V., and YU. I. VASSIL'EV, "Velocity Ratio of Longitudinal and Transverse Waves in Rocks, II," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 8, pp. 731-743.

VESIAC No. 1497 This paper considers the dependence of the velocity ratio of the longitudinal and transverse waves vp/vs on the frequency in a heterogeneous medium. The authors present and discuss a tabulation of the vp/vs values in rocks.

MOLOTOVA, L. V. See Kovalev, O. I.

MONAKHOV, F. I., "Frequency Selection of Ocean-Storm Microseisms," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 3, pp. 251-255.

VESIAC No. 1555 Recent investigations have shown that energy losses from the propagation of microseisms along the ocean bottom are far greater than those from continental microseisms. This severely limits the possibilities of using microseisms to trace the passage of cyclones over the ocean. Microseisms originating far from shore become too weak for detection by ordinary seismic stations.

The paper also gives the results of attempts to isolate such microseisms at continental and island points by means of frequency selection.

MONAKHOV, F. I., and N. A. DOLBILKINA, "The Structure of Microseisms," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 8, pp. 537-541.

VESIAC No. 1288 An azimuthal recording arrangement in Yalta was used for investigations of the character of particle motion in microseismic waves from sources in the Black Sea and the North Atlantic. Love waves were almost completely absent in every case; Rayleigh waves, uncomplicated by interference, made up about 5% of Black Sea and approximately 15% of North Atlantic microseisms. The majority of oscillations have a complex character, which is more strongly expressed in Black Sea microseisms. The oscillation planes of Rayleigh waves are generally oriented toward the origin of the microseisms, usually forming an angle with the vertical.

MONAKHOV, F. I. and N. A. DOLBILKINA, "The Structure of Microseisms and Methods of Determining the Direction of the Source of Their Origination," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 10, pp. 974-976.

VESIAC No. 708 Microseisms were recorded in the vicinity of Moscow with an 8-channel azimuthal arrangement; the maximum sensitivity axis of the seismographs tilted 45° to the horizontal. Profile measurements allowed the elimination of waves resulting from the interference by microseisms propagating along directions at angles in excess of 10°.

The directions and velocities of the remaining waves were then determined. The directions were exclusively northwesterly and did not go beyond the boundaries of the Scandinavian Peninsula. The longer the area of strong waves in the Norwegian Sea, the wider the propagation sector of the microseisms and the greater the number of correlative seismic waves, although they comprise only an insignificant portion of the total number of oscillations. The more localized the propagation sector, the less the microseismic interference. The mean propagation velocity was 3.3 ± 0.3 km/sec.

61% of all waves recorded at all profile points represent elliptically polarized oscillations with planes tilted at larger than 45° to the horizontal and oriented toward the area of seismic excitation. Particle motion corresponds to Rayleigh waves. Polarized oscillations may be formed through interference by waves propagating in different directions.

MOONEY, H. M., "A Study of the Energy Content of the Seismic Waves P and pP," Bull. Seis. Soc. Am., 1951, Vol. 41, No. 1, pp. 13-30.

VESIAC No. 335 The energy observed in P and pP seismic waves in a number of earthquakes was compared with theoretical predictions. Depth of focus, distance from the epicenter to the observing station, geographical location of the epicenter, and azimuth from the observing station were treated as variables. The results differed from theoretical predictions in that P energy appeared to increase, and pP decrease, with depth. Changes in the theoretical assumptions or numerical values which would account for these differences could not be found. The

report suggests that slight changes in the slope of the velocity vs. depth curve may account for the slight variation with distance between observed and theoretical energies.

MOZZHENKO, A. N., Portable Magnetic Seismic Recording Station, AID Report 62-13, Aerospace Info. Div., 1962.

VESIAC No. 909 The report describes and diagrams a portable seismic field recording unit, which amplifies and records three-component seismograph outputs. It also records minute and hour time marks. The tape record is played back at various speeds, amplified, and fed to a loop-oscillograph for photo-recording and to a cathode ray tube for visual observation. Tests at Turkmenskaya, S.S.R., indicate that the unit is practical for recording from 0.5 to 12 cps.

MUELLER, S. See Ewing, M.

MUNIN, A. S. See Keilis-Borok, V. I.

MURATOV, M. V. See Levitskaya, A. Ya.

MURPHEY, B. F., "Explosion Craters in Desert Alluvium," Proc. Geophys. Lab. Cratering Symposium, Part I, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1145-G Explosion craters in desert alluvium have been formed over a range of energy releases from 256 to 1 million pounds (SCOOTER event) of TNT. SCOOTER Crater is 307 feet in diameter and 75 feet deep. An empirical scaling law in which crater dimensions vary with the energy release to the 0.3 power best relates dimensions from small to large chemical explosions. Consideration of overburden leads to a partial explanation of the failure of cube-root scaling. Optimum depth of burst for 256-pound chemical explosions in desert alluvium is near 10 feet. Diameter-depth ratios vary from roughly 6 or 8 to 1 for surface bursts to 4 to 1 for bursts at optimum depth.

MYACHKIN, V. I., and R. N. SOLOV'EVA, "Study of the Propagation of Elastic Waves of Ultrasonic Frequency Over Small Distances in Rocks, Under Conditions of Natural Deposition," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 37-44.

VESIAC No. 1464 This article presents a method for studying the propagation of elastic waves at short distances with frequencies on the order of 50 kc. It describes results of studies in the Kalush potassium mine, where the velocities and elastic constants in the potassium salts are determined.

NAFE, J. See Brune, J.

NALECZ, M., and I. ZAWICKI, "A Hall-Effect Seismograph," Bull. Seis. Soc. Am., 1962, Vol. 52, No. 2, pp. 439-454.

VESIAC No. 1792 This article discusses the principle of operation and the amplitude and phase frequency of a new type of seismograph; it compares this type with an electrodynamic seismograph. The new seismograph may also be used as a tiltmeter. Its action is based on utilizing the Hall effect in semiconductors. Included in the report are experimental results obtained with the new device.

NANDA, J. N., "Discussion on the 'Origin of Microseisms,'" J. Geophys. Res., 1961, Vol. 66, No. 8, pp. 2597-2598.

VESIAC No. 706 This brief note presents objections to the Longuet-Higgins theory that interference of opposite components in the two-dimensional wave spectra of the sea surface might give pressure on the sea bottom and generate microseisms. The mathematics of the theory results in unequal probabilities of phase-space elements and conflicts with the requirements of the ergodic theorem.

In the Longuet-Higgins theory the seismic disturbance is calculated for a mean pressure term acting at a point, but for the generation of microseisms the resultant force must be a vector sum, which approaches zero very rapidly. The random phase pressure of an incoherent sea is likely to be dissipated and scattered back by bottom irregularities, causing bottom ripples.

The author's own theory does not require a coherent sea, but derives the observed amplitude of microseisms if the cyclic terms in the sea roughness are assumed to be in phase over about 30 wavelengths.

NAUGLE, J. E., "NASA Energetic Particles Program," Proj. VELA, Proc. of Symposium, 1960, pp. 249-266 (OFFICIAL USE ONLY).

VESIAC No. 734-P
AD 253 702

NERSESSOV, I. L. See Gzovsky, M. V.

NEVES, A. S., The Magneto-Telluric Method in Two-Dimensional Structures, Ph. D. Thesis, Dept. Geol. & Geophys., Mass. Inst. Tech., Cambridge, Mass., 1957.

VESIAC No. 810 The magneto-telluric method is a procedure for determining subsurface conductivity, especially at great depths. It consists of finding the impedance normal to the earth's surface by measuring, at several frequencies, the horizontal components of the electric and magnetic vectors of the magneto-telluric field, a naturally occurring electromagnetic field that can be described in terms of plane waves incident on the earth. This method has been extended from layered media to arbitrary media, particularly two-dimensional geometries. A finite difference method has been developed to treat electro-magnetic wave propagation in any two-dimensional geological formations.

The dissertation gives examples of the response of inclined layers. Measurements of magnitude and phase angle, taken separately, may lead to confusion with layered media; simultaneous recordings of both quantities avoid the possibility of mistaken interpretations. Included is a report on laboratory scale-model work.

NEWLANDS, M., "Lamb's Problem with Internal Dissipation, I," J. Acous. Soc. Am., 1954, Vol. 26, No. 3, pp. 434-448.

VESIAC No. 1942 This article theoretically investigates the response of an elastic half-space to a vertical impulse at the surface. Dissipative properties are incorporated in the medium, and the author assumes dissipation coefficients λ' and μ' varying as the nth power of the frequency. These lead to dispersion and absorption. The response may be described by components of the three distinct types, P-, S-, and R-. Each is observed at the surface as a train of waves culminating in a characteristic phase about the instants r/α, r/β, and r/γ, respectively, where α, β, and γ are the velocities of propagation of P-, S-, and R-waves in nondissipative media and r is the focal range. The article discusses these phases in detail, defining their "amplitude" and "span" and deriving the variations of each of these quantities and their ratios with r, density p and the material constants. It outlines a schematic determination of λ and μ (the elastic constants), n, λ', and μ' from experimental data.

NEWMARK, N. M. See Tung, T. P.

NEWTON, R. G., "A Progressing-Wave Approach to the Theory of Blast Shock," J. Appl. Mech., 1952, Vol. 19, pp. 257-262.

VESIAC No. 884 This paper deals with a theoretical description of the motion of a spherical shock wave in a homogeneous medium, such as a blast shock in free air. It explains a concept of "progressing wave" and compares this concept with that used by other authors. From a simple assumption about the motion of the progressing wave the paper derives an ordinary second-order differential equation for the shock front. Conservation of energy in the shock sphere reduces this to an ordinary first-order differential equation. Examination of the asymptotic behavior of the wave reveals that the original assumption in its simplest form contradicts conservation of energy. Modifying the original assumption allows for the deriving of new equations, including asymptotic values. The paper derives values for the high-pressure approximation (i.e., near the center of the explosion) and, finally, asymptotic as well as high-pressure values for the pressure decay behind the shock front.

NIKITIN, V. N., "Recording of Converted Refracted $P_1S_2P_1$ Waves for the Purpose of Computing the Elastic Constants of Diabase Covered by Alluvium," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 8, pp. 794-803.

VESIAC No. 1395 This article describes a way of recording converted refracted $P_1S_2P_1$ waves and discusses the criteria for identifying waves of this type. It presents the results of determining Young's modulus for diabase from the velocities of longitudinal and transverse waves on a large number of profiles and evaluates the relative errors resulting from the computation of Young's modulus by approximation (from the velocity of the longitudinal waves).

NIKITINA, V. N., "On Diffraction Taking Place in Absorbing Media Along a Half Plane," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 10, pp. 961-964.

VESIAC No. 1516 The article discusses the problem of diffraction of an electromagnetic field along a half plane in a uniform conductive space. It examines the influence exerted by the absorbing properties of the enclosing medium on the relative intensity of the diffracted electric field and draws conclusions with respect to the domain of applicability of the method of radio-wave sounding.

NORDQUIST, J. M. See Richter, C. F.

NORDYKE, M. D., Proceedings of the Geophysical Laboratory—Lawrence Radiation Laboratory Cratering Symposium, I, Rept. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1145 Part I of these proceedings contains the papers given on the first day of the meeting. These deal with meteor and explosion craters. Their titles are "Pacific Craters and Scaling Laws," "Nevada Test Site Nuclear Craters," "Explosion Craters in Desert Alluvium," "High-Explosive Craters in Tuff and Basalt," and "A Generalized Empirical Analysis of Cratering."

NORDYKE, M. D., Proceedings of the Geophysical Laboratory—Lawrence Radiation Laboratory Cratering Symposium, II, Rept. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1146 Part II of these proceedings contains the papers given on the second day of the meeting. These deal with cratering theory and calculation, throw-out calculations and lunar craters. Some of the titles are "Calculations of Underground Explosions," "Cratering from a Megaton Surface Burst," "Evaluation of Missile Hazard, Underground Shot," "Ballistics and Throwout Calculations for the Lunar Crater Copernicus," and "Notes on the Theory of Impact Craters."

NOZIERER, P. See Carron, J. P.

NUCKOLLS, J. See Maenchen, G.

NUTTLI, O. W., "A Method, Using S-Wave Data, of Determining the Direction of Horizontal Forces Which Produce an Earthquake," Earthquake Notes, 1958, Vol. 28, pp. 12-14.

VESIAC No. 916 It has been noted that fault-plane solutions based on P data, with a single couple mechanism assumed, indicate that earthquakes in most regions of the world are associated with transcurrent faulting. It is well known, however, that the P-wave method gives two solutions, each of which satisfies the data. This paper suggests a simple method for using S waves to choose between the two P-wave solutions. The legitimacy of representing the focal mechanism by a single couple is not considered.

NUTTLI, O. W., "A Note on the Refraction and Reflection of Plane Elastic Waves at an Interface with a Large Velocity Contrast," Earthquake Notes, 1958, Vol. 29, pp. 45-46.

VESIAC No. 915 The author analyzes the effect on seismic waves of a layer of alluvium which has a P-wave velocity of 1/10 and a density of 1/2 that of the underlying rock. Poisson's ratio for both materials is assumed to equal 0.25. By solving the Zoeppritz equations, one may compute the ratios of the amplitude of reflected and refracted P and S waves versus the amplitude of the incident P wave and graphically plot for angles of incidence from 0.0 to 1.5 radians. At small angles of incidence the amplitude of the refracted P wave is almost twice that of the incident P wave. All refracted P and SV waves have nearly vertical ray paths in the alluvium regardless of the angle of incidence. Because the alluvium is usually not greater than 1.0 km thick, only waves with a period of less than 1.0 second will be affected.

NUTTLI, O. W., "Tentative Velocities of Seismic Crustal Waves in the Central United States," Earthquake Notes, 1956, Vol. 27, pp. 41-44.

VESIAC No. 921 The report gives tentative figures for the velocities of seismic crustal waves from the earthquake of January 29, 1956, whose epicenter was calculated to be near Henning, Tennessee (35° 26' N, geocentric, 39° 36' W). The seismograms of 12 stations (e.g., Little Rock, St. Louis, Chapel Hill) were available for study. The report gives estimated velocities for several kinds of waves. For example, by a least squares solution the velocity of P_n was found to be 8.19 km/sec with a standard error of ± 0.03 km/sec; the amplitudes of S_n were small in comparison with the other S phases, a least squares solution giving a velocity of 4.67 ± 0.02 km/sec. The report presents some simple earth models which could give rise to the observed travel times.

OBORINA, S. F., "On the Crustal Structure of the Arctic Region," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 6, pp. 534-536.

VESIAC No. 1578 This article discusses a determination of the crustal structure along a travel path from the Alaska area to the Pulkovo seismic station on the basis of surface-wave observations.

O'BRIEN, P. N. S., "A Discussion on the Nature and Magnitude of Elastic Adsorbtion in Seismic Prospecting," Geophys. Prospecting, 1961, Vol. 9, pp. 261-275.

VESIAC No. 2016 Laboratory measurements indicate that seismic absorbtion in sedimentary rocks lies in the range 0.1 to 1.0 db/wavelength. Field measurements on the amplitude attenuation of direct, reflected, and refracted pulses give values consistent with this.

If the absorption is linear, dispersion must occur. If it occurs, field measurements show that it must be less than 1% over the frequency range 20 cps to 20 kc.

Seismic pulses broaden so slowly with distance that, if the absorbtion is linear, it must be less than that measured in the laboratory by a factor of at least ten. This is inconsistent with the amplitude measurements and would mean that emplaced rocks are more perfectly elastic than steel.

Seismic absorbtion must therefore be non-linear. It is assumed that for large values of Q the non-linear equation of motion may be linearised (Knopoff and MacDonald, 1958) for Fourier synthesis. If this is valid, then the attenuation per unit distance must be practically independent of frequency and dispersion must be negligible.

Whatever mechanism is acting must produce an attenuation of roughly one db/1000 feet and a pulse broadening of about 1% to 2% in the same distance.

More field and laboratory experiments are necessary to determine the physical mechanism by which absorbtion takes place.

OBUKHOV, V. A., "Automatic Spectrum Analyzer of Ultrasonic Oscillations Recorded During Seismic Modeling," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 10, pp. 983-991.

VESIAC No. 1613 The paper describes an automatic analyzer of the spectrum of ultrasonic oscillations recorded during seismic modeling. It presents specific analyses of such oscillations.

OBUKHOV, V. A., "The High-Sensitivity LS-1 Laboratory Seismoscope," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1147-1153.

VESIAC No. 1436 This paper discusses a principle of operation and arrangement of the high-sensitivity LS-1 laboratory seismoscope. The amplification coefficient of the seismoscope amplifier is equal to 2.8×10^6. The amplitude of the electric pulses from the emitter is 1200 volts. This device permits the highly accurate modeling of low-intensity wave processes, an example of which is a record of a diffracted wave.

OFFICER, C. B., M. EWING, and P. C. WUENSCHEL, "Seismic Refraction Measurements in the Atlantic Ocean, Part IV: Bermuda, Bermuda Rise, and Nares Basin," Bull. Geol. Soc. Am., 1952, Vol. 63, pp. 777-808.

VESIAC No. 904 This report describes the results of a series of refraction profiles made in the vicinity of the Bermuda Islands and along two lines of traverse extending south and southeast of Bermuda to the northern

perimeter of the Nares Basin. On the profiles made near the Nares Basin four seismic layers were determined. Over the Bermuda Rise only one high velocity basement was determined.

Important structural features are the depressions in the basement and the disappearance of the Mohorovicic discontinuity on the Bermuda Rise. On the profiles made in the vicinity of the Bermuda Islands, the truncated cone of the Bermuda volcanoes is measured with an average velocity of 4.25 km/sec. The results of the depth calculations from these profiles, the deep boring on Hamilton Island, and the known geology of the islands are in agreement with Daly's hypothesis (1910) on the effects of glaciation on atolls.

OGURTSOV, K. I., "Evaluation of the Intensities of Seismic Waves Which Are Reflected from a Very Weak Boundary of Separation," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 10, pp. 951-954.

VESIAC No. 1514 This article discusses the intensities of reflected waves for vertical incidence with a consideration not only of the zero (acoustical) approximation, but also of the first approximation, which is the next term of the asymptotic series representing the solution. It shows that in the case of a very "weak" boundary of separation, the first approximation may be comparable or even large in comparison with the zero approximation.

OGURTSOV, K. I., and A. V. BUROVA, "Intensities of Longitudinal and Transverse Waves Propagating at the Boundary of a Half Space," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 2, pp. 93-96.

VESIAC No. 1252 In this paper the intensities of non-stationary longitudinal and transverse waves at the boundary of an ideal elastic half space are calculated for different values of Poisson's ratio; the paper gives curves representing the ratio of these intensities versus $y = V_s/V_p$. Analogous calculations were given in I. P. Kosminskaya's "Amplitude Curves and Graphs of Phases of the Seismic Waves at the Free Boundary of a Half-Space," Bull. Acad. Sci. USSR, Geophys. Ser., 1956, No. 1, for a harmonic source and $\sigma = 0.25$.

OLIVER, H. W., L. C. PAKISER, and M. F. KANE, "Gravity Anomalies in the Central Sierra Nevada, California," J. Geophys. Res., 1961, Vol. 66, No. 12, pp. 4265-4271.

VESIAC No. 1890 More than 1000 measurements of gravity in the central Sierra Nevada and adjacent regions to the east show a decrease in regional Bouguer gravity values from -75 mgal at the western edge of the mountains to a minimum of about -235 mgal just west of the Sierra crest, a distance of only 100 km. Farther east a positive regional gradient of about 0.6 mgal/km continues into the Inyo-White Mountains for a distance of at least 60 km. Local gravity lows are associated with Cenozoic sediments in Owens Valley, Long Valley, and Mono Basin to the east of the Sierra Nevada and with a thick, narrow deposit of Pleistocene sediments in Yosemite Valley. Local gravity highs are

associated with roof pendants of metavolcanic rocks which extend down into the Sierra Nevada batholith to depths of more than 2 km. The variation in the regional Bouguer gravity values of about 160 mgal can be explained by a thickening of the earth's crust from 35 to 52 km beneath the central Sierra Nevada, combined with an eastward decrease in the density of the Sierra Nevada batholith from 2.76 to 2.64 g/cm^3. Gravity data support Romney's conclusion, based on seismic evidence, that a local mountain root exists under the central and southern parts of the Sierra Nevada and not under the lower northern part, in general accordance with regional isostasy.

OLIVER, J., "Body Waves in Layered Seismic Models," Earthquake Notes, 1956, Vol. 27, No. 4, pp. 29-38.

VESIAC No. 920 This paper presents the results of applying the seismic model technique to some simple layered configurations. These include a single layer with both top and bottom surfaces free; a single layer with the top surface free and the bottom bounded, first by a lower velocity material of semi-infinite extent, and, second, by a higher velocity material of semi-infinite extent; and a single layer whose velocity is a continuous function of depth. One phase traveling as a shear wave to and from a boundary and along the boundary in the same medium as a compressional wave was definitely identified, probably for the first time in multi-layered configurations. A two-dimensional model technique was used, employing plexiglass, vinyl, and aluminum.

The paper concludes that the multiplicity of the phases studied and their amplitude dependence on the radiation pattern of the source as well as on reflection coefficients at the interfaces indicates some of the difficulties associated with interpretation of near-earthquake, explosion and mechanical-impact seismograms. A satisfactory method of constructing models in which the velocity is a continuous function of depth has been developed.

OLIVER, J., Final Report Under Contract No. AF 19(122)441, Lamont Geol. Obs., Palisades, N. Y., 1955.

VESIAC No. 1184
AD 61 129 Theoretical and experimental investigations of seismic wave phenomena have revealed significant new knowledge about the structure of the earth's crust, mantle and core. The report pays particular attention to seismic surface waves; coupling between the atmosphere and the oceans or the ground; microseism characteristics, mechanisms, and causes; quarry blast recording for the determination of crustal structure; and model investigations of significant seismic problems.

OLIVER, J., "Ocean Bottom Seismographs," Technical Aspects of Detection and Inspection Controls of a Nuclear Weapons Test Ban, Pt. 2, App. 5, U. S. Gov. Printing Office, Washington, D. C., p. 760, 1960.

VESIAC No. 781-All Determining seismic motion on the ocean floor should produce useful information. Seismic noise should be low, especially in the 30-mcs range. Higher frequency components of P waves should appear

primarily on the vertical seismometer; S waves, on the horizontal. Surface waves across oceanic paths need study.

P waves generated from inland shocks may turn into T phases of one cps or more; this, plus the efficiency of underwater sound propagation, suggests that ocean stations might be valuable detectors of coastal earthquakes. Microseisms and low-frequency sounds could well be studied with ocean bottom seismometers. The report considers various types of seismometers and methods of collecting their data.

OLIVER, J., and J. DORMAN, "On the Nature of Oceanic Seismic Surface Waves with Predominant Periods of 6 to 8 Seconds," Bull. Seis. Soc. Am., 1961, Vol. 51, No. 3, pp. 437-455.

VESIAC No. 1052 The train of normally dispersed, short-period, oceanic surface waves, commonly identified by the nearly sinusoidal nature of all three components of ground motion in the period range of about 6 to 8 seconds, corresponds to propagation in the first Love and first shear normal modes. The report gives theoretical dispersion curves which agree with the observed dispersion of these short-period waves, as well as with dispersion of Rayleigh waves and Love waves of longer periods, for layered models of the oceanic crust which are consistent with results of seismic refraction studies. To obtain good quantitative agreement between theory and observation, one must include the effect of the small but finite rigidity of the deep-sea sedimentary layer in the calculations.

OLIVER, J., and M. EWING, "Normal Modes of Continental Surface Waves," Bull. Seis. Soc. Am., 1958, Vol. 48, No. 1, pp. 33-49.

VESIAC No. 1877 When the path between epicenter and station traverses only continental structure, the dispersion of the entire train of directly arriving seismic surface waves can be explained as the result of normal mode propagation in a crust-mantle system in which the velocity increases with depth within the crust. At least four modes—the Rayleigh mode, Sezawa's M_2 mode, and the first two Love waves—may appear prominently on the seismogram. The characteristics of the higher-mode dispersion curves permit the explanation of the Lg phase of Press and Ewing, Båth's Lg_1 and Lg_2, and, in some cases, Caloi's S_a without recourse to a low-velocity layer in the crust or mantle. Speculation on changes in these curves for less simplified models indicates that the remaining cases of S_a as well as Leet's C or coupled wave may be explained by classical theory.

The occurrence of the higher-mode waves is widespread; they are found on the four continents for which data are available. Higher-mode data, particularly when combined with information from the fundamental modes, make surface-wave dispersion, previously a useful tool, a much more potent method for the study of crustal structure.

OLIVER, J., M. EWING, and F. PRESS, Crustal Structure of the Arctic Regions from the Lg Phase, Tech. Rept. No. 38, Lamont Geol. Obs., Palisades, N. Y., 1954.

VESIAC No. 1196
AD 37 479

The Lg surface wave was used to distinguish areas of continental crustal structure from areas of non-continental structure in the arctic regions. Water-covered areas of continental structure include the Canadian Archipelago, parts of Baffin Bay and Davis Strait, the shallow parts of the Bering and Greenland seas, the Barents Sea, and the Bering Strait. Areas of noncontinental structure include the Arctic Ocean; the Beaufort, Greenland, and Norwegian seas; and the deep parts of the Bering Sea. Nowhere was continental structure detected beneath oceanic depths.

OLIVER, J., M. EWING, and F. PRESS, Two-Dimensional Model Seismology, Tech. Rept. No. 33, Lamont Geol. Obs., Palisades, N. Y., 1953.

VESIAC No. 1179
AD 23 446

Many problems in seismology may be solved by means of ultrasonic pulses propagating in small-scale models. Thin sheets serving as two dimensional models are particularly advantageous because of their low cost, availability, ease of fabrication into various configurations, lower energy requirements and appropriate dilatational-to-shear-velocity ratios. Four examples are flexural waves in a sheet, Rayleigh waves in a low-velocity layer overlying a semi-infinite high-velocity layer, Rayleigh waves in a high-velocity layer overlying a semi-infinite low-velocity layer, and body and surface waves in a disk.

OLIVER, J. See Brune, J.; Press, F.; Sutton, G.

OPIK, E. J., "Notes on the Theory of Impact Craters," Proc. Geophys. Lab. Cratering Symposium, Pt. II, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1146-S

This report discusses quantitative consequences of a schematic theory of meteorite impact and represents in standard form the interpolation formulas for penetration and mass-eroded (crushed) meteorites. From these formulas and independent consideration of the size of surviving fragments, one obtains consistent values of mass and velocity (around 2×10^6 tons and 15 km/sec) of the Canyon Diablo meteorite.

The close order of magnitude of these estimates is further supported by the agreement between predicted and observed numbers of craters in Mare Imbrium. The observed mean ellipticity of lunar craters is compatible with low-velocity impact into relatively soft material; the ideas on lunar cosmogony and structure have been based on an independent array of observational data.

The report also considers escape throwout and ejection of rock fragments from the moon by meteorite impact. Impacts below 11 km/sec would lead to accretion; impacts above 11 km/sec would lead to depletion of lunar material.

From consideration of survival of ejected fragments, the study concludes that meteorites of lunar origin must be less frequent than one for every 500 stony meteorites falling to earth. Breakup of stony meteorites by aerodynamic pressure prevents the formation on earth

of craters less than 1 km in diameter. The report includes tables for meteor and micrometor frequencies and for the puncture risk of space vehicles.

ORR, R. J. See Birkenhauer, H. F.

OSSIPOV, I. O., "Reflection and Refraction of Plane Elastic Waves at the Boundary of a Liquid and Solid Anisotropic Body," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 12, pp. 1148-1155.

VESIAC No. 1619 This paper solves the problem of reflection and refraction of plane elastic waves at the interface between a compressible liquid medium and a solid anisotropic half space with four elastic constants. The method is that of V. I. Smirnov and S. L. Sobolev. The report investigates the existence of Rayleigh surface waves in a two-dimensional case.

OSSIPOV, I. O., "Reflection and Refraction of Plane Elastic Waves at the Boundary of Two Anisotropic Media," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 5, pp. 424-431.

VESIAC No. 1565 This paper examines the problem of the reflection and refraction of plane elastic waves at the interface of two anisotropic media with three elastic constants. The problem is solved by the known method of V. I. Smirnov and S. L. Sobolev. V. A. Sveklo later used it to solve dynamic problems of elasticity for the case of anisotropic media.

PAIGE, S., "Sources of Energy Responsible for the Transformation and Deformation of the Earth's Crust," Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., 1955, pp. 331-342.

VESIAC No. 1043 This paper offers an eclectic hypothesis regarding processes and sources of energy governing the transformation and deformation of earth's crust. Relatively light, sialic continental segments of the earth's crust, essentially sedimentary in origin, have grown from small centers or lineaments to their present size, throughout geologic time.

Of all the discontinuities within the gravitational field of the earth, the most important is that between the atmosphere and hydrosphere above and the lithosphere below.

Volcanism is linked to the potential energy of the earth's residual heat, to gravitation, to the effects of the temperature-pressure gradient on the melting of rocks, and to imbalance between continental and oceanic segments. Volcanism on the ocean floors implies subsidence of these floors.

The processes of continental evolution outlined imply a continuous deformation of the earth's surface in time, but not in place.

PAKISER, L. C., Crustal Structure in Western United States, Part 1: Summary of Crustal Studies by the U. S. Geological Survey, ARPA Order No. 193-61, U. S. Geol. Surv., Denver, Colo., 1962 (OFFICIAL USE ONLY).

VESIAC No. 1125 VU

PAKISER, L. C., F. PRESS, and M. F. KANE, "Geophysical Investigation of Mono Basin, California," Bull. Geol. Soc. Am., 1960, Vol. 71, pp. 415-448.

VESIAC No. 337 Gravity and seismic studies completed during the summer of 1957 in Mono Basin, Mono County, California, revealed a large, roughly triangular block that had subsided about 18,000 ± 5000 feet and received an accumulation of about 300 ± 100 cubic miles of light elastic sediments and volcanic material of Cenozoic age. The seemingly near-vertical faults that bound this great block are displaced toward the center of the basin from the surrounding mountain masses, but in general they are parallel to well-defined Basin and Range trends.

The article concludes that Mono Basin may be a volcanic-tectonic depression caused by subsidence along faults, following extrusion of magma from a magma chamber at depth. Volcanic rocks of Pliocene and Pleistocene ages are exceptionally abundant in this area.

PAKISER, L. C. See Jackson, W. J.; Oliver, H. W.

PALERMO, C. J. See Cutrona, L. J.

PANASENKO, G. D., "The Seismic Character of the Kola Peninsula and North Kareliya," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 8, pp. 1-10.

VESIAC No. 1697 This article describes earthquakes recorded on the Kola Peninsula and in North Kareliya. Comparison of geological and geomorphological data leads to setting up seismogenetic zones: (1) the Murmansk coast from the Srednii peninsula to the Mazen' estuary; (2) the Kovdozero lowland across Kandalaksha bay to the Severnaya Dvina estuary; (3) along the principal cross-section of the Kola peninsula and (4) along the line Oulu (Finland)-Ukhta-Kem'. Included is a map of epicenters and seismic zones.

PARKHOMENKO, E. I., "A Study of the Triboelectric Effect in Rocks and in Certain Dielectrics by Means of a Dynamic Method," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 32-36.

VESIAC No. 1463 Marble, plexiglas, polystyrene, amber and ebonite, having been electrified by friction, display very strong electrical oscillations when elastic vibrations pass through them. The article makes conclusions concerning the bulk polarization of the dielectric appearing during the frictional electrification process; these are based on the presence of polarity in the effect and on observations of the inverse tribcelectric effect in marble and plexiglas.

PARKHOMENKO, I. S., "The Intensity of a Head Wave During Its Passage Through a High-Velocity Layer, Studied on Models," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 4, pp. 255-259.

VESIAC No. 1270 The paper shows the results of an experimental study of the change in intensity of a refracted head wave during its passage through a high-velocity layer. It examines cases in which the wave strikes the layer at angles smaller than, equal to, and greater than the critical angle for longitudinal waves. Furthermore the report discusses the relationship between the amplitude of the head wave and the ratio of the thickness of the layer to the wave length. The results of the investigation agree with the findings obtained from other experiments and, in some cases, with the results obtained from theories for stationary vibrations.

PARKHOMENKO, I. S., "Model Experiments for Studying the Traversal of a Head Wave Through a High-Velocity Layer," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 2, pp. 114-118.

VESIAC No. 1256 This paper presents the results of experiments which show the effect of the ratio d/λ (thickness of bed to wave length) on the shape of the refracted head wave and on the [seismic drift]* if the waves traverse a high-velocity layer of finite thickness. It discusses cases in which the angle of incidence is greater and less than the critical angle for longitudinal waves, and it shows that a wave changes its shape while traversing a layer. If the angle of incidence is equal to the critical angle, the [seismic drift] increases in comparison with the above cases. The experimental results corroborate the mathematical solution of this problem.

* Translation suggested by the editor; also, possibly, "stepout."

PARKHOMENKO, I. S., "On the Intensity of a Wave Which Has Passed Through a Series of Layers with Higher Velocity, I," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 5, pp. 474-479.

VESIAC No. 1367 The investigation demonstrated that the amplitude of a wave which has passed through a series of layers may be greater or less than the amplitude of a wave which has passed through a single layer whose thickness equals the total thickness of the series of layers. The investigation was carried out with solid-liquid models by means of a supersonic-impulse seismoscope.

PARKHOMENKO, I. S., "On the Intensity of a Wave Which Has Passed Through a Series of Layers Having an Increasing Velocity, II," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 6, pp. 585-590.

VESIAC No. 1376 The paper adduces approximate calculations of the intensity of a plane standing wave that has passed through a series of layers having an increasing velocity and a finite thickness. The layers are far enough apart so that no reflected waves are superimposed upon passing wave between the layers. The findings agree with the experimental investigations with model-simulation described in an earlier article (I).

PARKHOMENKO, I. S. See Vassil'Yev, Yu. I.

PARKIN, B. R., A Review of Similitude Theory in Ground Shock Problems, Rept. No. RM-2173, The RAND Corp., Santa Monica, Calif., 1958.

VESIAC No. 1734
AD 156 012

This report reviews the available data on the dynamic behavior of soils, analyzing possible theories of soil dynamics. The results of this investigation are used to discuss the applicability of model scaling laws to the solution of ground shock problems. In addition, the report considers the usefulness of model studies as an aid in the evaluation of theories of soil dynamics.

PARLIN, R. B. See Anderson, W. H.

PARIISKY, N. N. See Pertsev, B. P.

PASECHNIK, YE. P, "Seismic and Air Waves Which Arose During an Eruption of the Volcano Bezymyanny, on March 30, 1956," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 9, pp. 650-653.

VESIAC No. 1300

On March 30, 1956, at 0611 GMT there occurred a vigorous eruption of the volcano Bezymyanny (on Kamchatka). The volcano had first renewed activity in 1955. With the eruption came a local earthquake of considerably more force than the weak shocks which had preceded it. Ground displacements, recorded by seismographs at the seismic station Klyuchi, reached values in excess of 800 at the time of the earthquake. Seismic waves were noted at many of the seismic stations of the USSR and other countries. The explosive character of the eruption (ashes were blown to a height of 40 km) caused a strong air wave, which travelled around the earth and was recorded by microbarographs located at a number of stations in the USSR.

This article presents the results of a study of the recorded seismic and air waves originating during the eruption.

PASSECHNIK, I. P., "Determination of the Parameters of Attenuation of the Waves P and S," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 12, pp. 1161-1163.

VESIAC No. 1533

The exponent n of the divergence function and the amplitude coefficient of absorption a are evaluated from amplitude curves of the waves P_n and S*; these waves were obtained on a longitudinal profile during underground nuclear explosions of 5 and 19 kt and also in the Arys' TNT explosion by two independent methods. For the P_n waves, which have periods of oscillation from 0.6 to 0.8 seconds, the average values are $n \approx 2.0$, $a = 0.0022\ km^{-1}$; for the S* waves, which have periods of 1.0 to 1.2 sec., $n \approx 1.7$, $a = 0.0023\ km^{-1}$.

PASSECHNIK, I. P. See Kogan, S. D.

PAVLOGRADSKY, V. A. See Volarovich, M. P.

PEKERIS, C. L., Z. ALTERMAN, and H. JAROSCH, Effect of the Rigidity of the Inner Core on the Fundamental Oscillation of the Earth, Tech. Note No. 3, Weizman Institute of Science, Contract No. AF 61 (052)-509, Rehovot, Israel, 1962.

VESIAC No. 1841 VU The "core" oscillation period of about 101 minutes diminishes rapidly with increasing rigidity μ of the inner core, reaching an asymptotic value of about 53.8 minutes at large μ. Simultaneously the amplitude spreads into the mantle, eventually assuming the pattern of a normal oscillation at the asymptotic period. The observed period of 53.9 minutes is reached at a value for μ of about $1/2 \times 10^{12}$ dyn/cm^2.

PEKERIS, C. L., Z. ALTERMAN, and H. JAROSCH, "Rotational Multiplets in the Spectrum of the Earth," Phys. Rev., 1961, Vol. 122, No. 6, pp. 1692-1700.

VESIAC No. 686 VU The doublets in the spectrum of the free oscillations of the earth which have been observed on the gravimetric (UCLA) and strainmeter (Pasadena) records of the great Chilean earthquake of May 22, 1960, are interpreted as multiplets arising from the rotation of the earth. The phenomenon is similar to the Zeeman effect, and is a realization of the mechanical analog from which Larmor deduced the "Larmor precession" in his interpretation of the Zeeman effect.

PERRIN, F. See Carron, J. P.; Mathey, R.

PERTSEV, B. P., "The Calculation of Zero Point Drift During Observations on Elastic Tides," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 4, pp. 376-377.

VESIAC No. 1353 This paper presents a modification of Doodson's method for eliminating instrument zero drift during observations on tidal deformations of the earth.

PERTSEV, B. P., "Harmonic Analysis of Elastic Tides," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 8, pp. 542-549.

VESIAC No. 1289 The article describes a harmonic analysis of a 29-day series of observations of elastic synodisolar tides. The method is based on the examination of 25 fundamental waves of a luni-solar tide-generating potential. It permits the singling out of the 5 largest waves—M_2, S_2, N_2, K_1, and O_1. The adduced example shows how to apply this method.

PERTSEV, B. P., N. N. PARIISKY, and M. V. KRAMER, "Comparison of Various Methods of the Harmonic Analysis of the Tidal Deformations of the Earth," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 2, pp. 159-160.

VESIAC No. 1333 This article compares four methods of the harmonic analysis of elastic tides by analyzing the theoretical values of the tide-generating

potential. Results show that in the amount of work involved all four methods are approximately equivalent. In regard to accuracy, however, Pertsev's method has a slight advantage.

PETERSON, L. See Winckler, J. R.

PETERSON, R. A. See Forbes, C. B.

PETRASHEN', G. I., "Certain Interference Phenomena in a Two-Layer Medium," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 10, pp. 22-36.

VESIAC No. 1706 This report is a study of how interference waves form in a thin laye., which is in rigid contact with a half-space. The assumption is that the source and the receivers of the oscillations are situated on the free surface. The report gives a detailed description of the basic wave phenomena.

PETROVA, G. N. and V. A. KOROLEVA, "Determination of the Magnetic Stability of Rocks Under Laboratory Conditions," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 5, pp. 493-497.

VESIAC No. 1370 This paper points out the necessity of determining the vectorial stability of remanent magnetization in rocks for utilizing data to discover the pole position during the various geologic periods. It briefly describes a method for determining stability under actual and laboratory conditions, and gives the theoretical premises for obtaining the degree of the magnetic stability according to Neel's theory. It also describes results of testing the magnetic stability of Siberian trap rocks in constant and alternating fields. The analysis shows that such stability is a more consistent characteristic of the rock than is the vector of remanent magnetization.

PETRUSHEVSKI, B. A., "On the Investigations of the Seismicity of the Territory of the People's Republic of China," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 12, pp. 1217-1223.

VESIAC No. 1442 The article briefly characterizes the seismo-geological structure of the Kansu corridor (northwest China), visited by the author in the latter part of the year 1958.

PHINNEY, R., R. GILMAN, and F. PRESS, Progress Report on a Short-Period Rotational Seismometer (Abstract), Program 43rd Ann. Meet., Am. Geophys. Union, Washington, D. C., 1962.

VESIAC No. 1797 An instrument is under development to record short-period (10 to 0.4 cps) rotational motion of the earth's surface about a vertical axis. Such a device should be sensitive only to SH polarized seismic waves and be able to separate these from SV and P waves in a manner independent of azimuth of approach. Shear waves should thus consti-

tute the first motion from an event. The article strongly rejects microseisms, which are largely Rayleigh-type surface waves.

The rotation associated with a seismic wave is described by the antisymmetric components of the deformation tensor and is thus inversely proportional to the wavelength. A 3.5 km/sec shear wave at a one-second period has an associated rotation of about 4×10^{-4} second of arc per micron of translation. This amounts to 0.9 mμ of motion at a transducer mounted on a lever arm 0.5 meter long. By proper choice of components it is possible to obtain 20 to 50 μv of output signal per micron of translational ground motion. It is necessary to obtain coincidence of the center of mass with the rotational axis to a precision of about 10^{-4} so that translational motion of the base does not excite the rotational mode of the seismometer.

PIKELNER, S. B., "Basic Notions of Magnetohydrodynamics," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 1, pp. 25-28.

VESIAC No. 1253 The article briefly discusses the ideas underlying magnetohydrodynamics, mainly the influence of the motion of a medium upon the magnetic field and the effect of the field on the medium.

PIPER, A. M., Operations WINDSTORM and JANGLE: ~~Geologic~~, Hydrologic, and Thermal Features of the Sites, U. S. Geol. Survey, Portland, Oregon, 1952. Also as Rpt. WT-343, Armed Forces Spec. Weapons Proj., Wash., D. C.

VESIAC No. 664 The report describes geological features of two sites—WINDSTORM on Amchitka Island in the Aleutians and JANGLE in Yucca Valley. At least partly on geologic grounds WINDSTORM was suspended.

At the Nevada site, valley fill is nonhomogeneous in texture and is cut by one fault roughly a mile from test sites. Two 1-kt blasts, 17 feet below surface and at surface, produced seismic-wave velocities in incoherent and moderately cemented valley fill from about 2000 to 3000 fps near the surface, and about 5000 fps at 500 feet.

In layers of compact caliche velocities were possibly as much as 10,000 fps. In much of the volcanic tuff bedrock velocities may have been little, if any, greater than in parts of the valley fill.

Density at test sites averaged 1.46 less than 2 feet below surface, 1.65 at greater depth, and 2.02 in caliche layers. Earth temperatures were taken and projected for test dates for adjustment of instruments.

Effects of JANGLE can not be readily scaled to a full-sized missile and an actual target because of inevitable differences in geology, humidity, and temperature from the Nevada Test Site.

POD"YAPOL'SKI, G. S., "An Approximate Expression for the Displacement in the Vicinity of the Principal Front When the Angle Between the Ray and an Interface Is Small," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 12, pp. 1238-1244.

VESIAC No. 1445 The article employs an exact solution of the problem of the propagation of an elementary, arbitrary wave, generated by an axially symmetric point source in a parallel-layered laminar elastic medium, to derive an approximate expression for the displacement near the principal front when the path of the seismic wave in one of the layers is inclined at only a small angle to the interface. The article applies the general formula in the particular case of a wave that is refracted on entering a medium with a higher longitudinal wave propagation velocity.

POD"YAPOL'SKI, G. S., "On a Certain Formula Connecting the Coefficients of Head Waves with Reflection and Refraction Coefficients," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1108-1113.

VESIAC No. 1430 The article analyzes the relationship between reflection and refraction coefficients.

POD"YAPOL'SKY, G. S., "Refraction and Reflection Indices for an Elastic Wave at a Layer," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 4, pp. 335-341.

VESIAC No. 1559 This article gives formulas for the numerical calculation of the refraction and reflection indices of elastic waves at a layer of constant thickness. It presents formulas in terms of the refraction and reflection coefficients at the boundaries of the layer and treats these coefficients as operators that transform the waveforms and their frequency patterns.

POD"YAPOL'SKI, G. S., "The Propagation of Elastic Waves in a Layered Medium, I," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 8, pp. 788-793.

VESIAC No. 1394 The paper analyzes the application to a multilayered medium of functional-invariant solutions of the dynamic problems of the theory of elasticity, as suggested by Smirnov and Sobolev, and the asymptotic evaluations obtained by Zvolinsky of the wave fields near the front of reflected and head waves. The analysis is limited only to those phenomena related to the characteristics of the wave field of the unit elementary wave.

POD"YAPOL'SKI, G. S., "The Propagation of Elastic Waves in Layered Media, II," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 9, pp. 913-919.

VESIAC No. 1411 The paper continues the analysis, begun in the preceding paper, of an arbitrary elementary wave. It adduces an exact expression for an axisymmetric case and gives a general method for determining approximate expressions for each rapidly changing part of the displacement field.

POMEROY, P. W., and G. H. SUTTON, "The Use of Galvanometers as Band-Rejection Filters in Electromagnetic Seismographs," Bull. Seis. Soc. Am., 1960, Vol. 50, No. 1, pp. 135-151.

VESIAC No. 1788 Microseisms with large amplitudes, intermediate periods, and durations of 4 to 9 seconds have been effectively removed from long-period seismograms with maximum magnifications near 50 seconds. This has been accomplished by using a galvanometer of natural period in the microseism range as a band-rejection filter.

Adding a filter galvanometer greatly increases the usefulness of these instruments for studies of long-period microseisms and for clear detection and resolution of the long-period components of both body and surface waves from small shocks at very great distances. Magnification equations and theoretical magnification curves show that extremely high sensitivities for desired periods and low sensitivities for undesired periods can be obtained by combining one or more filter galvanometers in seismograph systems, varying the damping constants and natural periods of the components, and varying the coupling between the components. Also, by proper choice of instrument parameters, undesired periods can be rejected without appreciable modification of the seismograph magnification for periods outside the rejection band.

POPOV, E. I., "Marine Measurements with the GAL Gravity Meter," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 12, pp. 1256-1260.

VESIAC No. 1448 The paper sets out the results of measurements made with marine gravity meters on board a vessel of approximately 6000 tons displacement. The mean quadratic errors of the observation points varied within the limits ±3.5 to ±14.0 mgal, depending on the amount of acceleration due to wave disturbance.

POPOV, I. I. See Arkhangel'sky, V. T.; Savarensky, E. F.

PORCELLO, L. J. See Cutrona, L. J.

POSPELOVA, G. A., "Origin if the Reversed Magnetization of Volcanic Rocks from Armenia and the Kuril Islands," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 21-28.

VESIAC No. 1461 Investigation of volcanic rocks from Armenia and the Kuril Islands showed Early Quaternary-Upper Pliocene rocks to be magnetized in a direction opposite that of the present geomagnetic field. A detailed investigation of the magnetic properties, the stability characteristics, the content of the ferromagnetic fraction, and the thermo-remanence of directly- as well as reversely-magnetized samples in the laboratory did not reveal any great differences among them. The origination of the reversed polarity of the rocks can be explained quite justifiably with the reversal of the earth's magnetic field during Early Quaternary-Upper Pliocene times.

POSTOLENKO, G. A. See Kondorskaya, N. V.

POWER, D. V. See Lombard, D. B.

PRESS, F., "Antarctic Seismology," Eng. and Sci. Monthly, June 1957.

VESIAC No. 345 The International Geophysical Year Program in Antarctic seismology will use a half-dozen seismograph stations to furnish data from earthquakes to determine average ice thickness for the region, in contrast to the point-by-point determinations of field parties with portable equipment to measure reflected sound waves of explosions. Results will depend upon occurrence of a suitably located earthquake.

To ensure recording of a sufficient number of earthquakes instruments have to be particularly sensitive to small earthquakes. Seismographs are especially designed to detect ice-guided waves and Lg waves (that is, seismic waves guided by channels in the earth's crust and indicating whether or not the path between earthquake and seismograph is interrupted). Thus, whether Antarctica is composed of islands or is a continental mass may be determined.

Other results expected are information on ice sheets affecting wouldwide sea-level and climate; information on the ice-buried topography, its geology, and its adjustment to the ice load; and data on the southern hemisphere, where relatively few seismographic stations are located. The absence of earthquakes would have broad geological significance; perhaps a new species of tremor, associated with motions in the ice sheet, will be recorded.

PRESS, F., "Rigidity of the Earth's Core," Science, 1956, Vol. 124, No. 3233, p. 1204.

VESIAC No. 340 The rigidity of the earth's core may be estimated from the amplitude ratio of shear waves reflected twice from the core at near-vertical incidence to those reflected once. Phases were identified by the presence of their surface images. The mean ratio for five earthquakes was 0.3, the decrease in amplitude being assigned to absorption by the mantle and loss on reflection from the core boundary. The calculations indicate the rigidity of the core to be between zero and an order of magnitude smaller than 10^{11}dyne/cm^2; unlike a normal solid, the ratio of rigidity to incompressibility would then be smaller than 10^{-3}.

PRESS, F., and W. BECKMANN, "Geophysical Investigations in the Emerged and Submerged Atlantic Coastal Plain, Pt. VIII: Grand Banks and Adjacent Shelves," Bull. Geol. Soc. Am., 1954, Vol. 65, pp. 299-314.

VESIAC No. 912 A reconnaissance refraction survey was conducted on the Grand Banks, St. Pierre Banks, Cabot Strait Trough, and Banquereau. Three stations on the Grand Banks indicated sedimentary layers ranging from 2300 to 10,700 feet thick. The sediments are underlain by basement rocks having velocities of 16,150 to 18,200 fps.

A striking feature, existing on a profile running from St. Pierre Bank across Cabot Strait Trough to Banquereau, is the occurrence under the trough of a prism of sediments that thickens to almost 15,000 feet near the northeast margin, where it is almost entirely truncated by basement rock.

The sequence of sub. .face layers found on the banks south and southeast of Newfoundland is like that reported for the submerged shelf off the northeast coast of the United States and the banks off Nova Scotia. The seismic results and the recent results from dredging and coring support the hypothesis that the shelf off eastern North America is a depositional feature dating back to at least Lower Cretaceous time. The physiographic differences north and south of Cape Cod are believed to be due to erosion. The data suggest a structural origin for the Cabot Strait Trough, although the possibility of subsequent modification by glaciation is not ruled out.

PRESS, F., and M. EWING, "An Investigation of Mantle Rayleigh Waves," Bull. Acad. Aci. USSR, Geophys. Ser., 1954, Vol. 44, No. 2a, pp. 127-147.

VESIAC No. 1924 This article describes the dispersion of Rayleigh waves for a new period ranging from 1 to 7 minutes. The group velocity curve shows a long-period and a short-period branch merging at a minimum value of 3.54 km/sec with a corresponding period of about 225 seconds. The known variation of velocity with depth in the mantle may account for the observed dispersion. The small scatter in the velocities and the absorption of these waves suggests that, unlike shorter-period surface waves, refraction and attenuation effects are negligible at the continental margins. From the absorption of mantle Rayleigh waves the internal friction in the upper mantle for periods of 140 to 215 seconds is given by $1/Q = 670 \times 10^{-5}$. This is of the same order as that reported from vibration measurements at audio frequencies on laboratory samples of crystalline rocks at normal pressure and temperature.

PRESS, F., and M. EWING, "A Theory of Microseisms with Geologic Applications," Trans. Am. Geophys. Union, 1946, Vol. 29, No. 2, pp. 163-174.

VESIAC No. 1229 This article gives a theory for the origin of microseisms; the theory is based on the normal mode propagation of sound in two layers. It explains the mechanism of transmission of seismic energy from a storm at sea and predicts that periods of 3 to 9 seconds will predominate, depending on the depth of the water and the elastic properties of the bottom.

By studying the periods of microseisms originating from storms whose positions are known, one may infer elastic properties of the ocean bottom to a depth of the order of several times the depth of the water.

PRESS, F., and M. EWING, Two Slow Surface Waves Across North America, Tech. Rept. No. 15, Lamont Geol. Obs., Palisades, N.Y., 1951.

VESIAC No. 1217 Surface shear waves (Lg) with initial periods of about 1/2 to 6 seconds, sharp commencements, and amplitudes larger than any conventional phase have been recorded for continental paths at distances up to 6000 km. These waves have a group velocity of 3.51 ± 0.07 km/sec; for distances greater than 20° they have reverse dispersion.

For distances less than about 10° the periods shorten, and Lg merges into the recognized near-earthquake phase Sg.

An additional large amplitude phase in which the orbital motion of the particle is retrograde elliptical and the velocity is 3.05 ± 0.07 km/sec has also been observed for continental paths.

It is believed that these phases are propagated through a wave guide formed by a superficial sialic layer. The problem of explaining the propagation of these surface waves is that of finding a crustal structure which is consistent with the other data of geology and geophysics and which will provide a suitable wave guide for the new phases.

PRESS, F., and M. EWING, "Waves with Pn and Sn Velocity at Great Distances," Proc. Nat. Acad. Sci. U. S., 1955, Vol. 41, No. 1, pp. 24-26.*

VESIAC No. 964 Since the installation of the long-period three-component seismograph at Palisades in June 1953, seismograms have revealed new phases and have given new information about old ones. This paper reports observations of phases related to Pn at epicentral distances of 69° to 79° and to Sn at distances of 52° to 125°. At such distances these phases must result from wave-guide action in which compressional waves in one case and shear waves in the other are trapped beneath the Mohorovicic discontinuity. The paper suggests a mechanism of transmission involving "whispering gallery" propagation in the mantle by multiple grazing reflections from the Mohorovicic discontinuity.

PRESS, F. and M. EWING, "Earthquake Surface Waves and Crustal Structure," Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., 1955, pp. 51-60.

VESIAC No. 1037 This paper describes crustal structure under continents and oceans as revealed by the most recent Rayleigh and Love wave dispersion data. These surface-wave determinations are concordant with the principal results from seismic refraction measurements. Since surface-wave studies lead to average properties of the crust across areas of continental or oceanic dimensions, they provide valuable supplementary data to the point-by-point refraction measurements. Regions inaccessible for refraction experiments may be explored by surface-wave methods. The velocity of shear waves in the upper silicic crust of continents deduced from study of the phase Lg is used in the interpretation of surface-wave data.

PRESS, F., and D. HARKRIDER, Propagation of Acoustic-Gravity Waves in the Atmosphere, Contribution No. 1086 on Contr. AF-49(638)910, Calif. Inst. Tech., Pasadena, Calif.

VESIAC No. 1806 VU The report uses homogeneous wave-guide theory to derive dispersion curves, vertical pressure distributions, and synthetic barograms for atmospheric waves. It finds a complicated mode structure involving both gravity and acoustic waves and studies various models

of the atmosphere to explore seasonal and geographic effects on pulse propagation. It also discusses the influence of different zones in the atmosphere on the character of the barograms.

The first arriving waves are controlled by the properties of the lower atmospheric channel. Comparison in the time and frequency domains of theoretical results and experimental data from large thermonuclear explosions allows for these conclusions: (1) the major features on barograms are caused by dispersion; (2) superposition of several modes are needed to explain observed features; (3) scatter of data outside the range permitted by extreme atmospheric models shows the influence of winds for A_1—wind effects and higher modes are less important for A_2 waves. The report includes a discussion on atmospheric terminations and how these affect dispersion curves.

PRESS, F., J. OLIVER, and M. EWING, Seismic Model Study of Refractions from a Layer of Finite Thickness, Tech. Rept. No. 34, Lamont Geol. Obs., Palisades, N. Y., 1954.

VESIAC No. 1181
AD 29 161

This report describes two-dimensional model experiments on refractions from layers of finite thickness. Refractions can be unreliable for velocity and depth determinations when they occur with wavelengths which are large compared to the layer thickness. Discrepancies reported between refraction velocities and bore hole velocities can be partially accounted for in this manner. Even simple two- and three-layer models can show such effects as misleading second arrivals, echeloning of travel time curves, masked layers, and selective absorption in the overburden.

PRESS, F. See Benioff, H.; Ewing, M.; Healy, J. H.; Oliver, J; Pakiser, L. C.; Phinney, R.

PRIǏMAK, G. I., "Certain Results of the Studies of the Statistical Microheterogeneity of a Sea Medium," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 8, pp. 805-810.

VESIAC No. 1599

This paper presents results from experimental investigations of the parameters and statistical characteristics of fluctuations in temperature and turbulent pulsations of current velocity in a sea medium.

PRONYEAVA, E. A. See Bulin, N. K.

RADZHABOV, M. M., "Determination of Boundary Velocities by Transverse Travel-Time Curves of Refracted Waves, I," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 12, pp. 870-877.

VESIAC No. 1316

This paper proposes a method of determining the boundary velocities from observing a system of overtaking transverse (non-longitudinal) travel-time curves of refracted waves. The author describes different systems of making observations on the line of the transverse profile and gives examples of determining boundary velocities.

RAITT, R. W., "Seismic-Refraction Studies of the Pacific Ocean Basin, Part I, Crustal Thickness of the Central Equatorial Pacific," Bull. Geol. Soc. Am., 1956, Vol. 67, pp. 1623-1640.

VESIAC No. 1769 On the Mid-Pacific and Capricorn expeditions seismic refraction observations were made at 42 stations scattered widely within an area of the Central Equatorial Pacific Ocean extending from latitudes 22° S to 28° N and longitudes 162° E to 112° W. At 29 of these stations velocities of about 8 km/sec or more were reached at the depth of greatest penetration of the refracted waves. The mean of these velocities was 8.24 km/sec.

The crustal thickness, defined as the depth below the sea floor at which the 8 km/sec velocity is reached, ranges from 4.8 km to 13.0 km. The distribution of thicknesses is bimodal with seven anomalous stations giving values between 10 and 13 km. The group of 22 stations believed to be typical of the deep Pacific Basin has an average thickness of 6.31 km with a standard deviation of 1.01 km.

RAPOPORT, M. B., "Methods of Ultrasonic Seismic Modeling," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 9, pp. 869-872.

VESIAC No. 1507 This article examines some modeling problems: formation of wave impulses, direction of pickups, and suppression of Rayleigh waves. The procedures proposed with respect to methods have been tested on solid two-dimensional models, but they may also be used in studies made on three-dimensional models.

RAPOPORT, M. B., "On the Reflection of Seismic Waves from Non-Specular Boundaries," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 2, pp. 118-124.

VESIAC No. 1545 This article considers the structure of the wave field when a nonstationary (quasi-sinusoidal) wave from a point source is reflected on a nonspecular boundary. The secondary diffracted waves that arise under certain conditions are propagated along the profile line with the dispersion of the phase velocity; this gives them special properties. These results have been confirmed by experiments on models of boundaries roughened at intervals. The secondary waves were isolated by laboratory use of the seismic method of variable directional reception (VDR). The results explain many of the features of the phenomena observed when the VDR method is used in prospecting.

RATNIKOVA, I. I. See Berzon, I. S.

REISNER, G. I., "Construction of Gradient Maps of the Rate of Vertical Tectonic Movements of the Crust, Based on an Example from the Northern Tien-Shan," Bull Acad. Sci. USSR, Geophys. Ser., 1960, No. 9, pp. 873-876.

VESIAC No. 1508 The author discusses methods of preparing gradient maps from geological data on the rate of vertical tectonic movements.

REISNER, G. I. See Gzovsky, M. V.

REZANOV, I. A., "The Ashkhabad Earthquake of 1948 and its Geological Background," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 6, pp. 407-413.

VESIAC No. 1279 This paper briefly discusses the effects of the earthquake and presents some ideas concerning the geological circumstances of its occurrence.

RICHMOND, J. See Herrin, E.

RICHTER, C. F., "Body Waves in Inhomogeneous Media," J. Geophys. Res., 1958, Vol. 63, pp. 607-608.

VESIAC No. 371 There are three types of waves in anisotropic media. In special cases it can be demonstrated that these waves also exist in inhomogeneous media which are isotropic. They must also be considered for more general cases. Independent of the physical hypotheses, splitting the displacement field into curl-free and divergence-free parts is possible. In the special case in which the Lame coefficients vary linearly with X and the density is constant, it is necessary to require the curl to banish in order to obtain an equation in dilatation only.

RICHTER, C. F., "Comparison of Block and Arc Tectonics in Japan with Those of Some Other Regions," J. Phys. Earth, 1960, Vol. 8, No. 1, pp. 1-10.

VESIAC No. 375 Five geographical subdivisions of Japan are compared tectonically with several other areas. The article compares an structural relationships (e.g., three-dimensional intersections of block and arc structures) in West Japan with those of the North Island of New Zealand. It also compares other sections of West Japan with areas in California and New Zealand, noting a difference in type of faulting. Deviation and fragmentation of fault lines creates a major problem in the study of all three areas.

The article lists northeast Japan's distinguishing structural features, which are very favorable for Pacific-type arc study, and establishes some degree of correlation between certain arc structures in Indonesia and Japan. It notes limited parallels between tectonic environments in the Italian and West Indian arcs and in Japan.

The tectonics of the Soviet Union and Japan are correlated in terms of geosynclines and platforms. Statistical methods (i.e., ascertaining the proportion of large to small shocks) help distinguish among areas of different tectonic type. In Japan these areas reveal gradational features that can be compared with those of arc and block tectonics.

RICHTER, C. F., "New Dimensions in Seismology," Science, 1958, Vol. 128, No. 3317, pp. 175-182.

VESIAC No. 370 This article reviews the development of instrumental seismology, as in determining epicenter and hypocenter, with main emphasis on the problems of measuring magnitude by the variation of amplitude with distance. Originally the amplitude from elastic body waves was correlated with epicentral distance, but instruments in world-wide use required recording amplitude of surface waves. These were inadequate for deep shocks, which were measured better by the elastic waves through the body of the earth.

Choice therefore depends upon convenience and utility, although Gutenberg suggests that the use of elastic body waves may be superior, because the results are more simply related to energy calculations, and that perhaps magnitude should be stated in terms of ergs. Richter believes that elastic body waves can not be used until the original scale of magnitude can be converted.

In fact, a magnitude scale has practical applications that energy calculations may not have. It supplements without replacing the older intensity scales, which are not precise measurements but descriptions of surface effects in terms of physical damage, among other things. A magnitude scale bears usefully on the distribution, frequency and risk of dangerous types of earthquakes, about which there has been much statistical fallacy.

RICHTER, C. F., History and Applications of the Magnitude Scale, Contrib. No. 463, Calif. Inst. Tech., Pasadena, Calif., 1948.

VESIAC No. 362 This report presents a scale for fixing the magnitude of earthquakes. Magnitude is defined as the logarithm of the maximum trace amplitude recorded at a distance of 100 km by a Wood-Anderson torsion seismometer designed to have the constants $T_o = 0.8$, $V = 2800$, and $h = 0.8$. The zero point is arbitrarily chosen as a trace amplitude of 0.001 mm at a distance of 100 km and a depth of 18 km. The report tabulates the zero points computed for distances less than, and greater than, 100 km. It also tabulates magnitudes of shallow earthquakes recorded at various distances; these magnitudes have been based on the maximum combined horizontal ground amplitude of 0.001 mm and a period of 20 seconds.

RICHTER, C. F., "International Recovery in Seismology," Sci. Monthly, 1948, Vol. 66, No. 1, pp. 67-70.

VESIAC No. 363 This article is a brief history of seismological stations from 1904 to 1947, with interruptions during World Wars I and II. It gives the status of seismological stations and records as of September 1947.

RICHTER, C. F., "The Seismological Laboratory and Earthquake Study," Eng. & Sci. Monthly, 1948, Vol. 11, No. 2, pp. 11-12.

VESIAC No. 364 This article briefly surveys the history, organization, and activities of the Seismological Laboratory of the California Institute of Technology and its relationship to international seismology. It discusses the seismometrical survey of Southern California, the principal geologic faults, and the major earthquakes of the area.

RICHTER, C. F., and J. M. NORDQUIST, "Instrumental Study of the Manix Earthquakes," Bull. Seis. Soc. Am., 1951, Vol. 41, No. 4, pp. 347-387.

VESIAC No. 367 This report presents completed data for 38 shocks of the Manix series; it determines epicenters, depths, and the results on crustal structure and wave velocities. In the preliminary report (Richter, 1947) most shocks were grouped A and B. These are now sub-divided A1, A2, A3, and A4. The proper choice of origin times brings the travel times for the several shocks at any one station into close coincidence. The hypocenters for Group A are at the usual depth; those for B, nearer the surface. C designates a few epicenters near A, but with small depth, like B. Group D is additional shocks from an epicenter to the southwest, presumably unrelated to the Manix shocks. Epicenters A1 to B follow an alignment which strikes about N 30° W, crossing the Manix Fault at a large angle. Compressions and dilatations suggest right-hand strike slip on a hypothetical fault following the line of epicenters, or with left-hand strike slip on the Manix fault. The latter displacement was found; the article suggests that both occurred.

RICHTER, C. F., and J. M. NORDQUIST, "Minimal Recorded Earthquakes," Bull. Seis. Soc. Am., 1948, Vol. 38, No. 4, pp. 257-261.

VESIAC No. 365 Small earthquakes near Riverside have been identified with magnitudes as low as 0.4 and energy of the order of 10^{12} ergs. The number of shocks increases regularly with decreasing magnitude.

Magnitude was originally defined (Richter, 1935) as the logarithm of maximum displacement, in microns, of the trace by a torsion seismometer at an epicentral distance of 100 km. Trace amplitude of one μ represented a magnitude of zero, revised so that a magnitude of 0.2 would now be 0.6 (Gutenberg and Richter, 1942).

The magnitude of a small shock is derived by comparing its trace amplitude at a close station with that of a shock large enough to be recorded elsewhere with a magnitude determined for it. The approximate constancy of the ratio between the amplitudes recorded for two selected shocks is basic.

Energy radiated by the shock of the smallest recorded magnitude, 0.4, was calculated thus. The focal distance r to Riverside is about 20 km; the density d may be taken as 3 gm/cc; and the velocity v of S waves, as 3 km/second. Then the total kinetic energy in a spherical shell of the thickness of one wave length with the given radius and period T = 0.1 second is: $KE = 4\pi^3 r^2 A^2 vd/T = 4 \times 10^{11}$ ergs. The energy radiated in the shock must be taken as four times this quantity, since approximately equal energies are radiated in P and S waves, and the mean potential energy in the wave shell equals the mean kinetic energy KE.

RICHTER, C. See Benioff, H.; Chakrabarty, S. K.; Gutenberg, B.

RICKER, N., "Further Developments in the Wavelet Theory of Seismogram Structure," Bull. Seis. Soc. Am., 1943, Vol. 33, No. 3, pp. 197-228.

VESIAC No. 1116 In this paper the wavelet theory of seismogram structure previously proposed by the author has been extended to obtain the form of the seismic disturbance (due to a sharp seismic pulse) at various distances from the source. The solution of Stokes's differential equation is given in the form of a series of "wavelet functions," and calculated seismograms are presented to show the manner in which the shape, breadth, and amplitude of the disturbance vary with the distance from the source. The article includes tables of the wavelet functions and wavelet-form functions used in the calculations.

RILEY, W. F., and A. J. DURELLI, Diffraction Phenomena in Semi-Solids, Rept. No. K063, Armour Res. Foun., Ill. Inst. of Tech., Chicago, Ill., 1956.

VESIAC No. 1208 This program has developed a method to utilize dynamic photoelasticity and grid measurements for studying the propagation of stress waves around obstructions of various shapes partially or completely embedded in a homogeneous, isotropic, elastic medium.

A special wave-transmitting medium (a modified form of Ciba Araldite 502) was developed to permit the recording of a propagating stress wave using the commercially available Fastax Camera. The program also developed experimental and photographic techniques to the point where clear, precise photoelastic fringe patterns were obtained; and an embedded grid network for use in measuring displacements and strains.

Indications are that the present basic research will be useful in solving many important engineering impact problems which are extremely difficult to solve mathematically.

Since a relationship for the modulus of elasticity is found in many types of soil, this model method appears to promise an approach to the problem of stress wave propagation in soils. It is also possible that in the future it can be applied to a study of three-dimensional problems involving a nonhomogeneous medium.

RINEHART, J. S., F. L. SMITH, E. H. CRABTREE, and D. C. CARD, Jr., An Evaluation of the Pellet Technique for Measuring Momentum at the Surface of a Semi-Infinite Elastic Solid, Colo. Sch. Mines, Golden, Colo., 1961.

VESIAC No. 1209 The experiment was performed to test hypotheses about the reliability of the pellet technique used to measure momentum—and, hence, stress—at the surface of a semi-infinite elastic solid; in this case, plaster blocks. The experiment was designed so that an array of pellets lay across the top of each block, with the central pellet of the linear array located directly above the charge (source).

The observations upon the pellet whose axis to the source was normal to the surface gave results well within the expected range. These results were checked with data from electronic strain gages. An unexpected statistical result appeared: the variance in velocity across trials increased as the depth of source from surface decreased.

The results also showed that, under the present conditions, it would be impractical to measure the distribution of stress across the surface of the medium in any one trial with an array of pellets.

RINEHART, J. S. See Auberger, M.

RIZNICHENKO, YU. V., "The Mass Determination of the Coordinates of Local Earthquakes and of the Velocities of Seismic Waves in the Source Areas," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 4, pp. 243-248.

VESIAC No. 1268 The author suggests the plotting of isochrones as a method for determining the coordinates of local earthquakes, and the use of theoretical travel-time curves of direct (or penetrating refracted) waves to determine the focus. Both methods are based on the comparison of observed arrival times with precalculated theoretical travel-time curves. For determining average and layer velocities as functions of the observed depths of a series of earthquakes, the author suggests the use of vertical travel-time curves. All three methods are based on the assumptions and procedures applied in seismic prospecting.

RIZNICHENKO, YU. V., "On the Study of the Structure of the Earth's Crust During the Third IGY," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 2, pp. 1-14.

VESIAC No. 1664 This article presents a survey of methods for determining the deep-earth crustal structure, particularly with respect to the application of explosions. It reports on studies of the earth's crust designated for the third IGY, which will be conducted in the U.S.A. and the U.S.S.R. It is proposed that the U.S.S.R. investigations be carried on in the northwestern sector of the Pacific Ocean (i.e., mainly in the region of the Kurilo-Kamchatka arc).

RIZNICHENKO, YU. V., "The Study of Seismic Conditions," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 9, pp. 615-622.

VESIAC No. 1296 Seismic conditions are the total earthquake phenomena in a given area. Basically, earthquakes are characterized by a certain seismic energy and by quantities which locate their foci in space and time. From detailed observations on earthquakes in the highly seismic Garm Region of the Tadzh, SSR, the paper discusses some general statistical rules, typical for seismic conditions.

RIZNICHENKO, YU. V., and O. G. SHAMINA, "Elastic Waves in Layers of Finite Thickness," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 3, pp. 231-243.

VESIAC No. 1340 Ultrasonic pulse models were used for investigating elastic waves in a layer of intermediate velocity. The paper discusses the kinematic and dynamic characteristics of waves in layers of various thickness.

RIZNICHENKO, YU. V., O. G. SHAMINA, and R. V. KHANUTINA, "Elastic Waves with Generalized Velocity in Two-Dimensional Bimorphic Models," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 4, pp. 321-334.

VESIAC No. 1558 This paper derives formulas for propagating velocities of long longitudinal and transverse waves in thin bimorphic and polymorphic plates in two-dimensional modeling of seismic waves. The formation process of waves with generalized velocity has been investigates experimentally and the field of application of the long-wave theory has been evaluated. The amplitude characteristics of the longitudinal waves have been investigated by mean of a bimorphic model of a gradient medium.

RIZNICHENKO, YU. V., and O. G. SHAMINA, "Elastic Waves in a Laminated Solid Media, As Investigated on Two-Dimensional Models," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 7, pp. 17-37.

VESIAC No. 1691 This report gives an account of experimental studies of elastic waves connected with a high-velocity layer surrounded by an elastic medium. The investigators used the supersonic impulse method to stimulate waves in solid two-dimensional models of laminated media. The report discusses the kinematic and dynamic picture of the wave phenomena.

RIZNICHENKO, YU. V., and O. G. SHAMINA, "Multiple Reflected and Transmitted Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 12, pp. 1129-1139.

VESIAC No. 1529 This paper presents a theoretical discussion of a problem on dispersed summarized multiple waves, and on reflected and transmitted refracted seismic waves in a multi-layered medium with thin dispersion layers. It describes experiments on ultrasonic pulse modeling of reflection and transmission of seismic waves in a thin-layered medium. Finally, it compares the experimental results with theoretical computations.

ROBERTS, F. A., and A. T. DENNISON, "A Device for Overcoming the Effects of Static Seismic Shot Signals," Geophys. Propsecting, 1953, Vol. 1, No. 3, pp. 192-196.*

VESIAC No. 910 When refraction time signals are transmitted over a radio link between shooter and observer, there is a serious risk of interference from electrical storms. This risk can be minimized by sending a series of signals at fixed time intervals. The paper describes a simple device which will do this accurately.

ROBINSON, E. A., Case Study of Henderson County Seismic Record, Part I, MIT GAG Rept. No. 3, Mass. Inst. Tech., Cambridge, Mass., 1953.

VESIAC No. 1100 This report presents data used in a case study of a Henderson County, Texas, seismic record made by the Magnolia Petroleum Com-

pany. This report includes individual prediction errors and error curves for 28 sets of operator coefficients.

ROBINSON, E. A., Further Research on Linear Operators in Seismic Analysis, MIT GAG Rept. No. 6, Mass. Inst. Tech., Cambridge, Mass., 1954.

VESIAC No. 1103 This report discusses the generalized linear operator, filter characteristics, methods of determining the optimum linear operator, the directional filtering properties of multiple seismometers (an application of linear operator theory), filter criteria and frequency information, current available computing machinery and data-handling devices, an experiment on a Continental Oil Company seismogram, and a linear operator study of seismograms of the Atlantic Refining Company.

ROBINSON, E. A., Linear Operator Study of a Texas Company Seismic Profile, Part I, MIT GAG Rept. No. 4, Mass. Inst. Tech., Cambridge, Mass., 1953.

VESIAC No. 1101 This report contains computational results on records 12.0 to 12.18 from shot hole CLLX of a seismic profile of the Texas Company.

ROBINSON, E. A., On the Theory and Practice of Linear Operators in Seismic Analysis, MIT GAG Rept. No. 5, Mass. Inst. Tech., Cambridge, Mass., 1953.

VESIAC No. 1102 This report discusses the linear operator, its filter characteristics, properties of the cosine operator, computation of correlations and spectra, the error curve, the matrix inversion employed, a machine solution of the seismogram analysis problem, and some prediction errors for records treated in MIT GAG Report No. 1.

ROBINSON, E. A., Predictive Decomposition of Time Series with Applications to Seismic Exploration, MIT GAG Rept. No. 7, Mass. Inst. Tech., Cambridge, Mass., 1954.

VESIAC No. 1104 This report deals with the analysis of seismic records from the statistical point of view. It treats the theory of discrete stationary time series as developed by Wold, Wiener, and others. The central theme is the development of the concept of the predictive decomposition of stationary time series from the point of view of applications. The paper shows that the theoretical work of Wold antedated that of Wiener in certain important ways. The applications to seismic exploration deal with the case in which a section of seismic trace is additively composed of seismic wavelets, where each wavelet has the same stable shape, and where the strengths and arrival times may be considered to be random and uncorrelated with each other. For this case, the Predictive Decomposition Theorem tells us that the section of seismic trace is a section of stationary time series.

ROBINSON, E. A. See Wadsworth, G. P.

ROCARD, Y. See Mathey, R.

ROKITIANSKII, I. I., "Laboratory Studies of Induced Polarization in Sedimentary Rocks," Bull Acad. Sci. USSR, Geophys. Ser., 1957, No. 2, pp. 98-110.

VESIAC No. 1668 This paper summarizes results of laboratory investigations of induced polarization in silica sands. All substances used in experiments were chemically pure; specific resistivity and ζ-potential were measured concurrently. The investigators obtained functions with respect to chemical composition of the interstitial water, specific resistivity, ζ-potential, fluid content and degree of dispersion. They also studied transient characteristics.

ROLAND, F. H. See Werth, G. C.

ROMBERG, F. E., "An Oscillating System for a Long-Period Seismometer for Horizontal Motion," Bull. Seis. Soc. Am., 1961, Vol. 51, No. 3, pp. 373-380.

VESIAC No. 1789 This article describes an oscillating system suitable for use in a long-period horizontal-motion seismometer. The system consists of a short vertical pendulum whose gravitational restoring torque is opposed by a vertical zero-length spring. By adjusting the spring constant with respect to the mass of the pendulum, one can reduce the net restoring torque to almost zero, thus giving the system a long period. The period is less sensitive to tilt than that of the horizontal pendulums commonly used in seismometers for horizontal motion. The system's lateral dimensions are small, so that it is adaptable for use in a bore hole and for easy transportation and setting up. A stable period of 30 seconds has been observed in a prototype model.

ROMNEY, C. F., "Detection of Underground Explosions," Proj. VELA, Proc. of Symposium, 1960, ARPA, Washington, D. C., pp. 39-76 (OFFICIAL USE ONLY).

VESIAC No. 734-C
AD 253 702

ROMNEY, C. F., "Seismic Systems Development," Proj. VELA, Proc. of Symposium, 1960, ARPA, Washington, D. C., pp. 103-108 (OFFICIAL USE ONLY).

VESIAC No. 734-F
AD 253 702

ROSENBAUM, J. H., "The Long-Time Response of a Layered Elastic Medium to Explosive Sound," J. Geophys. Res., 1960, Vol. 65, No. 5, pp. 1577-1614.

VESIAC No. 1900 The article considers the long-time response of a layered elastic medium for the particular case of a point-source explosion in a liquid

layer lying above an infinitely deep liquid bottom. It obtains an asymptotic solution, valid for large values of the time variable, and it expresses the response in terms of harmonic vibrations of the liquid layer. The article emphasizes those vibrations which correspond to waves with small angles of incidence and which, because of radiation into the bottom, decay exponentially with time. However, it includes the well-known guided-wave phenomenon, first discussed by Pekeris in 1948.

The article makes a detailed presentation of the method of analysis. This method is applicable to more complicated problems of direct geophysical interest. It presents numerical results for some typical examples, the behavior of the phase velocity for the lower modes being of particular interest.

ROWE, R. D. See Clabburn, E. J.

RUNYAN, W. R., and J. F. MIFSUD, A Study of the Propagation of Sound Waves Near the Surface of the Earth and the Measurement of the Driving-Point Impedance of the Earth, Rept. No. DRL-A-88, U. of Texas, Austin, Texas, 1955.

VESIAC No. 997
AD 97 517

The report briefly summarizes past work on the acoustic detection of land mines. It carefully reviews conclusions and recommendations of the previous workers in the field. The Defense Research Laboratory believes that many of the research objectives outlined by previous contractors to Engineer Research and Development Laboratories will be met if the following research program is carried out:

(a) the development of an adequate theory of the elastic wave propagation in the surface of the ground
(b) the measurement of the driving-point impedance of the ground as a function of
    (1) different kinds of soils (sand, silt, clay)
    (2) different stratification of soils
    (3) moisture content of soil
    (4) packing of soil
    (5) discontinuities in soil, such as rocks, mine cases, etc.
    (6) frequency range from 50 to 1000 cps
    (7) different driver piston sizes
    (8) magnitude of static load
    (9) magnitude of driving force
(c) field measurement of the velocity and attenuation of acoustic waves in the surface of the ground as a function of the first six parameters listed above.

The report also discusses work already accomplished by the Defense Research Laboratory. This consists of the design of a system to measure the driving point of the ground in the frequency range of 50 to 350 cps; the measurement of the driving-point impedance of a silty sand and a clay soil as a function of frequency; and a few measurements of the velocity of the Rayleigh wave on the surface of a semi-infinite soil.

RUPREKHTOVA, L. See Vvedenskaya, A. V.

RUSTANOVICH, D. N., "Some Problems of the Investigation of the Seismic Activity of the Ashkhabad Region," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 1, pp. 9-21.

VESIAC No. 1660 This report examines the seismic activity of the Ashkhabad region from the findings of two seismological expeditions of the Geophysical Institute of the Academy of Sciences of the U.S.S.R. in 1949 and 1953. Seismic observations were worked out by the time-field method. The report examines the question of the variation of seismic activity in the Ashkhabad region over a period of time.

RUSTANOVICH, D. N., V. L. MASAITIS, and CH'ON HENG SUK, "The Seismicity of Korea and Aspects of its Seismotectonics and Seismic Zoning," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 10, pp. 939-954.

VESIAC No. 1607 This paper describes the seismicity of the Korean peninsula from historical and literary records and from instrumental readings and considers some aspects of seismotectonics and seismic zoning. It proposes a map of seismic zones for use in calculating the possible strength of seismic effects during the planning and constructing of industrial plants and public buildings in different seismic zones of the Peoples Republic of Korea.

RYKUNOV, L. N., "P Waves Diffracted at the Earth's Core and Rigidity of the Core," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 7, pp. 678-696.

VESIAC No. 1383 The authors investigate the possibility of evaluating the shear modulus of the earth's core on the basis of studying the character of decrease in P-wave amplitudes in the shadow zone. In view of the considerable difficulties which arise in a theoretical study of the diffraction of the seismic waves at the earth's core, the investigation will be carried out by models.

RYKUNOV, L. N., and S. V. MISHIN, "Some Features of Microseism Propagation Along Continental Paths," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 6, pp. 529-533.

VESIAC No. 1577 This report investigates the influence of the earth's surface relief and of structural features in the upper parts of the crust on the intensity of microseisms. There are indications that the transverse (Love) components of microseisms are due to partial transformation of an initial Rayleigh wave.

RYZHOVA, T. V. See Alexandrov, K. S.

SAINT-AMAND, P., Los Terremotos De Mayo—Chile 1960, Tech. Art. No. 14, NOTS TP 2701, Michelson Labs., China Lake, Calif., 1961.

VESIAC No. 1803 This article presents an eyewitness account of the Chilean earthquakes of 1960. The earthquakes and the subsequent seismic sea waves

are discussed as to their origin, location, severity, and damage. Color maps show locations of magnitudes and geological structure and locations of fault zones.

SATO, Y., "Attenuation, Dispersion, and the Wave Guide of the G Wave," Bull. Seis. Soc. Am. 1958, Vol. 48, No. 3, pp. 231-251.

VESIAC No. 1933 Using the strain seismograms of the New Guinea earthquake of 1938 and the Kamchatka earthquake of 1952, the author determined the decrement of the G wave in the mantle of the earth from the comparison of the amplitude of Fourier components, which are obtained by analyzing the G phases at different epicentral distances. The value of 1/Q thus obtained is a little larger than that given by M. Ewing and F. Press using mantle Rayleigh waves, but is not much different. The phase velocity was also calculated using the argument of the Fourier transform. The dispersion curves obtained from (G_1 and G_3), (G_2 and G_4) of the New Guinea earthquake and (G_1 and G_3) of the Kamchatka earthquake agree quite well, and give a nearly consta :t group velocity, 4.4 km/sec, as was anticipated. Theoretical consi· eration of the distribution of shear velocity that serves as the wave channel for the guidance of the G wave was given. The shear velocity was calculated by applying the method of T. Takahaski to the dispersion curve derived from the condition of constant group velocity, which is a direct consequence of the fact that the G wave shows almost no dispersion. The $V_s(z)/V_o$ curve, which was derived theoretically, agrees well with the curve given by the distribution of shear velocity (of Jeffreys-Bullen) in the range between one and several hundred km.

SATO, Y., "Classification of Surface Waves and Related Topics," J. Geophys. Res., 1958, Vol. 63, pp. 635-636.

VESIAC No. 379 Surface waves may be classified according to the decay of amplitude exponentially or sinusoidally with distance perpendicular to the boundary surface. Given a two-dimensional system, parallel boundaries, surface-wave propagation parallel to the boundary with no geometrical spreading, and a homogeneous and perfectly elastic medium, the symbol (E) will designate waves with exponentially decaying amplitude normal to the boundary, and the symbol (S) waves with a sinusoidally decaying amplitude. If two body waves are involved, (EE) or (SS) may be used, depending upon the type of amplitude decay. Single bars over (E) or (S) designate a free surface; a double bar, a fixed surface. Love waves may be represented by ($\bar{S}$/E), Stoneley waves by (EE/EE); both require media of two different properties. Rayleigh waves, requiring only one medium, may be given the symbol ($\overline{EE}$). Phase types are expressed in n-letters; Rayleigh and Love waves are 2-phase; Stoneley waves, 4-phase. By setting up a correspondence between physical parameters (even though they vary continuously), SH-type waves may be demonstrated to be equivalent to acoustic waves. Critical comments following the paper point out that Love waves are anisotropic, and that pseudo-surface wave amplitude decays neither exponentially nor sinusoidally.

SATO, Y., and T. MATUMOTO, "Vibration of an Elastic Globe with a Homogenous Mantle over a Homogeneous Core—Vibrations of the First Class," J. Phys. Earth, 1961, Vol. 9, No. 1, pp. 1-16.

VESIAC No. 1050 This paper s arts by making a simplified assumption about the nature of the ea th's mantle and core; i.e., it assumes, heuristically, that the earth's mantle and core are homogeneous. The following conclusions ar reached: (1) existence of the core with large rigidity makes the frequency of torsional oscillation higher; (2) existence of the core with small rigidity decreases the frequency of fundamental mode and the period becomes very long; (3) however, when the core rigidity is small, there are higher modes whose periods are nearly equal to those in the case of the perfect liquid core, and the feature of motion in the mantle is also similar; and (4) although the displacement in the core is very large and is completely different from that in the case of perfect liquid, the observed period will be the one for these modes with undeveloped displacement distribution in the core.

SATO, Y. See Ewing, M.

SAVERENSKI, also spelled Savarenski, Savarensky, Saverensky.

SAVARENSKI, YE, F., "Research on Seismicity of Inaccessible Regions," Vestnik Akad. Nauk USSR, 1956, No. 6, pp. 78-81 (Russian ed.).

VESIAC No. 1027
AD 204 510 This paper outlines the proposed program in seismology for the International Geophysical Year. The decision to make the studies mentioned here was reached at the third assembly of the IGY Special Executive Committee, which met at Brussels in September 1955. The group decided to study the location of foci, intensity and frequency of earthquakes in inaccessible and neglected areas, above all in the Antarctic, where the expeditions of several nations will participate. The same work will be carried out in the Arctic and in the equatorial and tropic zones. A chart shows the epicenters of earthquakes in the sub-Antarctic zone. A second chart, of Soviet origin, shows the seismicity of the Arctic. Of the two, the Arctic has been studied more fully. The program of the IGY is to include a careful study of microseisms and of the structure of the earth's crust.

SAVARENSKII, E. F., "Seismological Work in Japan," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 12, pp. 29-46.

VESIAC No. 1717 This article is a review of the state of seismological observations in Japan up to 1957.

SAVARENSKY, E. F., "An Elementary Evaluation of the Influence of a Layer on Vibrations of the Earth's Surface," Bull. Acad. Sci. USSR, Geophys. Ser. 1959, No. 10, pp. 1029-1032.

VESIAC No. 1420 The influence of a damping layer on a vertically incident longitudinal wave or on an SH wave striking in some arbitrarily chosen direction is evaluated. The evaluation is important for seismic zoning.

SAVARENSKY, E. F., "On the Determination of Group and Phase Velocities from Observations," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1102-1107.

VESIAC No. 1429 The paper analyzes the physical elements and the methods for determining the group and phase velocities of seismic surface waves.

SAVARENSKY, E. F., and I. V. AIVAZOV, "On the Determination of the Azimuths and Emergence Angles of a Seismic Radiation," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 3, pp. 253-259.

VESIAC No. 1342 The paper presents the determination and analysis of angle parameters of the seismic rays of longitudinal waves, based on data obtained from two earthquakes in 1957.

SAVARENSKY, E. F., I. I. POPOV, and A. P. LAZAREVA, "Observations of Long-Period Waves of the Chilean Earthquakes of 1960," Bull. Acad. Sci. USSP, Geophys. Ser., 1961, No. 8, pp. 744-749.

VESIAC No. 1596 Data are presented on the long-period Rayleigh surface waves observed during the Chilean earthquake (22 May, 1960) at the Simferopol, Moscow, and Pulkovo seismic stations. Waves with periods up to 500 seconds, repeatedly circling the earth, were found. The dispersion of their velocities and damping were determined.

SAVERENSKY, E. F., "The Determination of the Apparent Velocities of Seismic Waves in the Caucasus," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 2, pp. 119-122.

VESIAC No. 1327 The author discusses the possibility of the occurrence of P head waves at shorter distances than commonly accepted in data processing. He presents a very simple method for checking the accuracy of interpretation of longitudinal waves of local earthquakes. An example of earthquake analysis is given.

SAVARENSKY, E. F. See Bulin, N. K.; Waldner, N. G.

SAVARENSKY, E. T., O. N. SOLOV'EVA, and B. N. SCHECHKOV, "On Love Wave Observations at Moscow Seismic Station and on the Structure of the Earth's Crust," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 5, pp. 469-473.

VESIAC No. 1366 The paper discusses questions on the method of determining the thickness of the Earth's crust by analyzing Love waves (assuming a one- and a two-layered model of the crust). Use is made of propagation data of Love waves that have been observed over the wavepath from the vicinity of Japan to the seismic station of Moscow.

SCHEIDEGGER, A. E., "The Geometrical Representation of Fault-Plane Solutions of Earthquakes," Bull. Seis. Soc. Am., 1957, Vol. 47, No. 2, pp. 89-110.

VESIAC No. 1907 Investigations into the mechanism at the focus of an earthquake have been in progress for a long time. It has been demonstrated that the mathematical model of a simple fault is a plausible assumption, at least so far as the explanation of the direction of first motion at distant seismic observatories is concerned.

There are an infinite number of representations of fault-plane solutions, all of which satisfy certain basic requirements. However, only four have reached any popularity. It is shown that three of these four representations are entirely equivalent.

SCHUYLER, G. L., "Computations of the Directions of Microseisms at Tripartite Stations," Bull. Seis. Soc. Am., 1955, Vol. 45, No. 4, pp. 285-288.

VESIAC No. 712 This paper suggests a quick approximate method for finding the directions from which microseisms arrive at tripartite stations. A major purpose is to point out that the potentialities of tripartite stations are not likely to be fully realized until the computation techniques they now commonly employ are drastically modernized in a way similar to the one described here.

SCRASE, F. J., "The Reflected Waves from Deep-Focus Earthquakes," Proc. Roy. Soc. London, Ser. A, 1931, Vol. 132, pp. 213-235.

VESIAC No. 1066 The effect of an abnormally deep focus on the reflected waves of earthquakes is considered. In general a number of supplementary reflected waves may occur, and if the focus is sufficiently deep, they should produce definite separate phases on the records. The travel times of both the supplementary waves and the more normal waves have been derived for several depths of focus (C. G. Knott's paths of longitudinal and transverse waves being taken as a basis).

It is found that the beginnings of the additional phases can generally be recognized on the seismograms, and that the times of transit are in reasonable agreement with the calculated times. This finding is thought to be a definite confirmation of the occurrence of deep-focus earthquakes. Further, the appearance of the supplementary reflected waves provides a means of recognizing a deep-focus earthquake from the records of a single station.

The results of the investigation favour the idea that the initial phase of an earthquake is a direct compressional wave and is not generated by reflection of a distortional wave.

SEKERZH-ZEN'KOVICH, T. YA., "Some Particular Solutions of the Problem of the Propagation of a Free Tidal Wave in a Channel of Varying Depth," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 10, pp. 1041-1044.

VESIAC No. 1422 The propagation of a free tidal wave in an infinite channel of constant width is investigated. It is assumed that the depth of the channel varies linearly from one bank to the other, with the depth at zero at one bank and having some finite value at the other. The Coriolis force is taken into account in the solution.

Particular solutions are obtained in the form of Tchebycheff-Laguerre polynomials, and these solutions are analyzed.

SHAMINA, O. G., "Absorption of Longitudinal and Transverse Waves in Specimens of Various Forms," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1143-1146.

VESIAC No. 1435 The investigation of the absorption of longitudinal waves depends on the form of the specimen (block, plate, or rod). The determination of absorption of the longitudinal and transverse waves on two- and three-dimensional models was conducted simultaneously with the aid of a suggested method of recording a wave path at 45° to the sides of the specimen. A comparison of experimental and theoretical data is given.

SHAMINA, O. G., "An Investigation of the Dynamic Features of Longitudinal Waves in Layers of Different Thickness," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 8, pp. 754-760.

VESIAC No. 1499 The dynamic features of longitudinal pulse waves are investigated in a free layer and in a layer immersed in water. It is shown that the velocity, form, dominant period, and attenuation of a sliding wave in a free layer and a head wave from a layer in water are dependent on the thickness of the layer; the thinner the layer, the less will be the distance from the radiator within which it can be treated as a plate. The behavior of the wave amplitude is the most reliable indication that a longitudinal wave propagated in a layer with a velocity equal to the velocity in the plate is fully formed.

SHAMINA, O. G., and O. I. SILAYEVA, "The Propagation of Elastic Pulses in Free Boundary Layers of Finite Thickness," Bull. Acad. Sci. USSR, Geophys. Ser., 1958 No. 3, pp. 168-174.

VESIAC No. 1262 This paper describes experiments on the propagation of elastic pulses in free boundary layers of finite thickness. The experiments are based on the ultrasonic-pulse method and the technique of longitudinal profiling. It was found that longitudinal waves can traverse a layer at two different velocities only: one equivalent to the velocity of the longitudinal waves in the body, and the other equivalent to the velocity of a longitudinal wave in an infinitely thin plate. The wave pattern and the predominant wavelength are related to the thickness of the layer. The experimental results were compared to theoretical calculations. The conclusions may be important for the study of the dynamics of propagation of seismic waves in layered media.

SHAMINA, O. G. See Riznichenko, Yu. V.; Silaeva, O. I.

SHCHERBO, M. N. See Vassil'ev, Yu. I.

; HECHKOV, B. N., "Structure of the Earth's Crust in Eurasia from the Dispersion of Surface Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 5, pp. 450-453.

VESIAC No. 1569 The two-layered structure of the earth's crust in Eurasia is analyzed from surface-wave dispersion for the following trajectories: Central Asia-Kuril Islands; European part of the USSR-East China Sea-Japanese Islands. The thickness of the crust is deduced simultaneously from Love and Rayleigh waves, and the data obtained are compared with each other.

SHECHKOV, B. N. See Savarensky, E. T.

SHIROKOVA, E. I., "Determination of the Stresses Effective in the Foci of the Hindu-Kush Earthquakes," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 12, pp. 1224-1227.

VESIAC No. 1443 The author investigates the distribution of forces in the foci of the Hindu-Kush earthquakes located near $\Phi = 36\ 1/2^{\circ}$ N and $\lambda = 70\ 1/2^{\circ}$ E, at ~200 km depth. It was discovered that the compressive focal stresses act almost horizontally ($e \approx 10^{\circ}$) in NNW-SSE direction (~350°), and the tensile stresses almost vertically ($e \approx 85^{\circ}$) in SSW-NNE direction.

SHIROKOVA, E. I., "Some Facts on the Character of the Velocity Change in the Upper Layers of the Earth's Mantle," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 8, pp. 804-813.

VESIAC No. 1396 From an analysis of the amplitudes of longitudinal waves from deep-focus earthquakes which occurred in the Hindu Kush, the character of the velocity change in the propagation of longitudinal waves in the upper layers of the mantle of the Earth (down to a depth of 200 km) is determined. The direction of the radiation from the earthquake's focus is accounted for. The data obtained show that the low-velocity layer which begins, as is commonly assumed, at a depth at 60-100 km, can reach at least to a depth of 200 km, and that it has fairly discontinuous boundaries.

SHOEMAKER, E. M., "Ballistics and Throwout Calculations for the Lunar Crater Copernicus," Proc. Geophys. Lab. Cratering Symposium, Part II, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1146-Q Discrimination between lunar craters of impact origin and volcanic origin may be possible on the basis of the distribution pattern of the ejecta, a feature observable from the earth. The ejecta from a maar type of volcano (one whose crater resembles lunar craters) are almost invariably thrown out along high-angle trajectories, and shower down in a diffuse, more or less uniform, pattern around the crater. Ejecta from large-impact craters, on the other hand, are expected (by analogy with nuclear-explosion craters) to be thrown out along both high and low trajectories, leaving a pattern containing distinct streaks of rays. From

the ray pattern and the trajectories of the fragments that form the rays (the exterior ballistics), it is possible to reconstruct the fragmentation pattern on the ground (the interior ballistics of crater formation).

SHOEMAKER, E. M., and E. C. T. CHAO, "New Evidence for the Impact Origin of the Ries Basin, Bavaria, Germany," Proc. Geophys. Lab. Cratering Symposium, Part I, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1145-B The Ries basin is a shallow, nearly circular depression about 17 miles in diameter that lies between the Schwabian and Franken plateaus of southern Germany. Great masses of breccia and a system of thrust sheets associated with the Ries have been studied by German geologists for about a century. Werner and Stutzer suggested the Ries was an impact crater, but the consensus of the principal investigators has been that the basin was formed by some sort of volcanic explosion.

The only direct evidence of magmatic activity at the Ries is the presence of glass in scattered patches of a breccia called "suevit." Some of the glass has long been recognized as sintered fragments of old crystalline rocks. We have found that coesite, a high-pressure polymorph of SiO_2, and lechatelierite, SiO_2 glass, are constituents of the sintered rocks in the suevit. The occurrence of the same phases in sintered rock fragments at Meteor Crater, Arizona, suggests that the glassy components of suevit are of impact rather than of volcanic origin.

SHOEMAKER, E. M., and R. E. EGGLETON, "Terrestrial Features of Impact Origin," Proc. Geophys. Lab. Cratering Symposium, Part I, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1145-A Craters made by meteorites striking the earth are discussed, with attention given to geological evidence for discriminating them from craters formed by other structural processes. The major known meteorite craters are briefly described. Other features that are considered probable or possible meteorite craters, on the basis of less conclusive evidence, are noted. Separate tabulations are given of topographic features either known to be meteorite craters, or considered as possible meteorite craters through lack of conclusive evidence to the contrary, and to topographic features once considered to be possible meteorite impact craters, but which are now believed to be of other origin.

SHURBET, G. L. See Worzel, J. L.

SILAEVA, O. I., "Methods for the Study of the Elastic Properties of Rock Samples Under Pressure," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 2, pp. 145-149.

VESIAC No. 1331 Experiments were conducted on the elastic properties of rocks and the absorption of elastic waves in samples subjected to pressures of up to 1000 kg/cm^2. The supersonic-impulse method and the methods of longitudinal profiling were used in these experiments. It is shown that with increasing pressure, the elastic parameters (Young's modulus E,

shear modulus G, as well as Poisson's ratio σ) increase, and the absorption of elastic waves decreases. The results show that the methods of profiling hold much promise for the laboratory study of the elastic properties of rocks and the absorption of elastic waves.

SILAEVA, O. I., and O. G. SHAMINA, "The Distribution of Elastic Pulses in Cylindrical Specimens," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 1, pp. 17-24.

VESIAC No. 1251 Descriptions are given of experiments on the distribution of elastic pulses in metal specimens of cylindrical form. The experiments were conducted using the ultrasonic-pulse method and the method of longitudinal profiling. It has been established that longitudinal waves may be propagated in the specimens with two wave velocities; i.e., with velocity V_{P_M} equal to velocity of distribution of longitudinal waves in an infinite medium, and with velocity V_{P_R} equal to velocity of propagation of longitudinal waves in a thin rod. The relationships between the cross-sectional dimensions of cylindrical specimens and the length of the longitudinal wave have been determined—a determination necessary for the calculation of velocities of longitudinal waves in the specimens.

SILAYEVA, O. I. See Shamina, O. G.

SILVERMAN, D., "The Frequency Response of Electro-Magnetically Damped Dynamic and Reluctance Type Seismometers," J. Geophys. Res., 1939, Vol. 4, pp. 53-68.

VESIAC No. 1835 The steady-state shaking table has been used to determine the response, as a function of frequency and terminating resistance, of a dynamic and a reluctance seismometer. The observed response of the dynamic seismometer is shown to be identical with that predicted by theory. The response curves for the reluctance seismometer qualitatively substantiate analytical predictions of the value of terminating resistance for maximum damping, and of the shift (with decreasing resistance) of the peak of response to the higher frequencies. A short discussion of the electrical equivalent seismometer is given, and the experimentally determined response of a reluctance-type seismometer and that of its equivalent network are compared.

SIMPSON, S. M., Linear Operators and Seismic Noise, MIT GAG Rept. No. 9, Mass. Inst. Tech., Cambridge, Mass., 1955.

VESIAC No. 1105 A "phase-difference" method for estimating the s/n on a seismogram is found to be superior to a "circle-fitting" method. A method for direct estimation of signal strength vs. seismogram time, with stepout as a parameter, is described. Correlated decompositions (i.e., nonpredictive) were investigated in an effort to provide a more meaningful statistical model for simulating a wider range of physically specifiable situations. A summary of the criteria for stability and physical realizability for linear, passive, lumped-constant systems is presented.

An approximate calculation of the Ricker wavelets is worked out, and a method for improving the approximation is suggested. The practical consequences arising from the assumption that a seismic trace may be treated as a finite interval of an infinitely long stationary time series are examined; sample computations done on a stationary series generated by a seismic wavelet were used as a standard against which the behavior of seismic computations could be measured.

SIMPSON, S. M., Properties, Origin, and Treatment of Certain Types of Seismic Noise, MIT GAG Rept. No. 10a, Mass. Inst. Tech., Cambridge, Mass., 1956.

VESIAC No. 1106 This report contains linear-operator tables, and an account of move-out averaging experiments, stationarity tests, wavelet-contraction experiments, and scattering as a seismic noise source.

SIMPSON, S. M., Jr., et al., Properties, Origin, and Treatment of Certain Types of Seismic Noise, MIT GAG Rept. No. 10b, Mass. Inst. Tech., Cambridge, Mass., 1956.

VESIAC No. 1107 The scattering of seismic waves by small inhomogeneities in earth properties is considered, in order to facilitate inferences about earth properties from recorded seismograms. Two mathematical models containing statistical features have been investigated. In each the earth is taken to be unbounded, isotropic, and perfectly elastic. For the first model, the density is assumed constant; for the second, the density fluctuates. Qualitatively the two models give the same results. For wavelengths which are long with respect to the scale of the inhomogeneities, the damping constant of longitudinal waves depends on the fourth power of frequency. Some quantitative differences are found between the propagation characteristics of transverse and longitudinal wave motion in the same model. The frequency behavior predicted by this theory has been upheld in metals but not yet observed in measurements made on earth materials.

The authors discuss a statistical test of the hypothesis that a time series is stationary, and present a method for obtaining the stable, realizable wavelet associated with a given energy-density spectrum satisfying Wold-Kolmogoroff conditions for factorization.

SIMPSON, S. M., Jr., The Interrelation of the Deterministic and Probabilistic Approaches to Seismic Problems, MIT GAG Rept. No. 11, Mass. Inst. Tech., Cambridge, Mass., 1957.

VESIAC No. 808 This terminal, although not conclusive, report discusses the mathematics of random media, stationarity tests on seismic traces and well logs, some seismically important statistics of well logs, some problems of interpretation, and some theoretical seismograms which relate to the problem of surface motions resulting from buried charges.

SIMPSON, S. M., Jr., Time Series Techniques Applied to Underground Nuclear Detection and Further Digitized Seismic Data, Rept. No. AFCRL 62-262, Contr. AF 19(604)7378, Mass. Inst. Tech., Cambridge, Mass., 1961.

VESIAC No. 978 VU
AD 273 114

A mathematical treatment of the spectral-estimation problem for stationary time series is presented, including an analysis of bias, variance, and end effects for an optimum (Daniell) estimation technique. Numerical and programming analyses of correlations and cosine, sine transforms required to instrument the Daniell technique have resulted in high-speed general purpose subroutines. Work with linear operators pertinent to the detection problem was pursued. A linear-operator study, designed to compress the first few motions of the seismogram to a spike, was begun. The linear operator representing the impulse response of the short-period Benioff has been determined by transforming a pole-zero representation of the instrument transfer function. A total of 94 digitized records on IBM BCD magnetic tapes are made available. (Petroleum Abstract)

SKUGAREVSKAYA, O. A. See Tikhonov, A. N.

SKURIDIN, G. A., "Duhamel's Principle and the Asymptotic Solution of the Equations of Motion of the Theory of Elasticity. II," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 3, pp. 227-230.

VESIAC No. 1339

General solutions of the equations of motion from the theory of elasticity are used to obtain equations of the "jumps" of discontinuous (impulse) solutions and for the "jumps" of their derivatives with respect to time. The results are applied to obtain expressions for the coefficients of the asymptotic series derived in the first part of the present study. The equations obtained are identical to the conditions for the application of Duhamel's principle to the equations of elasticity theory. This fact proves that it is possible to use Duhamel's principle to obtain asymptotic solutions of the equations of motion of the theory of elasticity.

SKURIDIN, G. A., "On the Theory of Scattering of Elastic Waves from a Curvilinear Boundary," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 2, pp. 36-58.

VESIAC No. 1666

An approximate solution for the scattering of elastic waves at a curvilinear boundary is obtained from Kirchoff's theory. An analytic expression is obtained for the longitudinal and transverse reflected motions. It is shown that when a plane elastic wave is reflected at a curvilinear boundary, longitudinal and transverse waves diverging as $\rho^{-\frac{1}{2}}$ are generated. The head wave arising from a transverse wave falling upon a rigid curvilinear boundary is analyzed, and it is shown that several head waves are possible. Indicatrixes for the scattering of longitudinal and transverse waves are given with graphs illustrating their radial damping.

SMITH, F. L. See Rinehart, J. S.

SOIL MECHANICS LIMITED (Staff), Physical Test on Rocks Excelsior Adit, Kit Hill, Callington, Cornwall, Rept. No. 3334/1, Soil Mechanics Limited, London, Eng., 1960.

VESIAC No. 994 The United Kingdom Atomic Energy Authority is undertaking a series of non-nuclear explosive trials in Excelsior Adit, Kit Hill near Callington. In order to make an assessment of the trials we were asked to determine the following physical properties of the rocks from the Adit: density, moisture, specific gravity, porosity, strength, hardness, elastic moduli, thermal characteristics, and attenuation characteristics. Most of the tests were made in our laboratory on selected samples of the rocks. The methods of testing are described and illustrated. The results of the tests are presented in tabular and graphic form. In addition, a detailed geological inspection was carried out in the Adit in the vicinity of the trials, and a petrographic description was made on samples of the rocks.

SOIL MECHANICS LIMITED (Staff), Physical Tests on Rocks, Greensides Mine, Cumberland, Rept. No. 3401/1, Soil Mechanics Limited, London, Eng., 1960.

VESIAC No. 993 A large number of physical properties of rock samples from Greensides Mine, Cumberland were determined for the United Kingdom Atomic Energy Authority in connection with their non-nuclear explosive tests in the C.1. trial area of the mine.

Properties determined were density, moisture content, specific gravity, porosity, strengths, hardness, elastic moduli, and thermal characteristics.

The results of the tests made on selected samples of rock are presented in tabular form.

SOLOV'EV, also spelled Solov'yev.

SOLOV'EV, S. L., "Statistical Distribution of Earthquakes and Tectonic Structure of Seismic Zones," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 1, pp. 13-17.

VESIAC No. 1539 The statistical distributions of earthquakes in space and time may depend on the tectonic structure of the seismic zones. Such distributions consist of relationships between the frequency of weak and strong earthquakes and of the arrangement of the earthquakes with depth in the upper layers of the earth's mantle.

SOLOV'YEV, S. L., "Amplitude Variations with Distance in the Ground Particle Motion of Surface Waves of Kurilo-Kamchatka Earthquakes," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 11, pp. 762-770.

VESIAC No. 1308 This paper presents a study, made during Kurilo-Kamchatka earthquakes, on the variability with distance of the displacement and velocity of the ground particle motion of surface waves. It was found that these quantities do not decrease but that they increase during the transition

from the Far Eastern to the continental stations located at greater epicentral distances. On either side of this anomalous zone, the quantities decrease with distance in accordance with the laws established previously for earthquakes occurring in the continental areas.

SOLOV'EV, V. N. See Arkhangel'sky, V. T.

SOLOV'EVA, O. N. See Savarensky, E. T.

SOLOV'EVA, R. N. See Myachkin, V. I.

SOROKHTIN, O. G., O. K. KONDRAT'EV, and YU. N. AVSYUK, "Methods and Principal Results of Seismic and Gravimetric Studies of the Structure of the Eastern Antarctica," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 3, pp. 265-268.

VESIAC No. 1479 A brief description is presented of the methods of seismically and gravimetrically determining the thickness of ice under Antarctic conditions. The expediency of this methodology is shown. A cross-section of the glacial cover along the profile Mirnyi-Pole of Inaccessibility is described. Some conclusions are drawn about the geological structure of the East Antarctic mass.

SPACE-GENERAL CORPORATION (Staff), Earth Currents From Underground Nuclear Detonations, Rept. No. 43R-18, Contr. No. AF 33(600)-42406 (VT/196), Space-General Corp., El Monte, Calif., 1962.

VESIAC No. 1846 VU Experimental facilities were established for the GNOME and HARDHAT tests to measure and record the components of the electromagnetic field generated by underground nuclear detonations. In addition, an instrumentation system was established at the GNOME site to investigate the characteristics of the plasma generated by the blast to obtain information concerning the nature and source of the electromagnetic signals generated by low-yield, close-coupled, underground nuclear explosions which are small in magnitude and cannot be detected above background noise at distances greater than a few kilometers from ground zero. Final conclusions concerning the feasibility of electromagnetic detection of decoupled underground nuclear detonations can be made only after the electromagnetic signals from such explosions have actually been measured.

SPARKS, N. R., and P. F. HAWLEY, "Maximum Electromagnetic Damping of a Reluctance Seismometer," Geophysics, 1939, Vol. 4, No. 1, pp. 1-7.

VESIAC No. 1834 An explicit solution of the third-order differential equation of motion of an electromagnetically damped reluctance seismometer is obtained for the case of greatest interest, i.e., the case where the terminating resistor is adjusted to give greatest damping. This solution shows that definite interrelationships among the instrument constants are necessary for appreciable damping. The theoretical limitations on the maximum damping obtainable are discussed.

SPENCER, A. J. M. See Black, M. C.

SPRINGER, D. L. See Werth, G. C.

STAKHOVSKAYA, Z. I., and M. P. VOLAROVICH, "The Study of Young's Modulus of Rock Samples Under Pressures of Up to 5000 kg/cm^2 by the Method of Bending," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 5, pp. 329-335.

VESIAC No. 1274 This paper describes the apparatus for study of Young's modulus of rock samples under high pressures by the method of bending. The methods of measurements of stress and of deformations with tensometers are explained. It is shown that Young's modulus of rocks sharply increases in the range of pressures between 1 and 1000 kg/cm^2; the rate of its growth declines with further increase in pressure up to 5000 kg/cm^2.

STALLYBRASS, M. See Flammer, C.

STAM, J. C., "Modern Developments in Shallow Seismic Refraction Techniques," Geophysics, 1962, Vol. 27, No. 2, pp. 198-212.

VESIAC No. 1153 The refraction technique has been adapted to the solution of engineering problems since the early thirties. In both Europe and the United States, a more simplified and lighter type of equipment is used than in oil exploration. With correct shooting patterns, very accurate depth determinations can be carried out. However, this operation is too expensive for many engineering problems. At first, a portable three-channel seismograph was developed, but in 1952 a one-channel instrument was built in Africa, consisting of a timing unit, amplifier, and display unit. Other instruments and methods have since followed. The natural field of the one-channel equipment is in areas of shallow overburden, where a hammer can be the source of energy. This procedure can have tremendous application in road construction. Another application is in surveys of short duration, where cost must be kept down. Certain conditions, however, will still require the use of multi-channel equipment.

STARODUBROVSKAYA, S. P., "Tracing Buried Dislocation Zones by Means of Dynamic Characteristics of Refracted Waves," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 5, pp. 2-21.

VESIAC No. 1680 It has been shown that dynamic characteristics of refracted waves can be used for tracing dislocations in metamorphosed rocks. It has been established that the characteristic properties of records in the region of dislocated rocks are monotypic in every case investigated, regardless of the texture of the medium and the genesis of metamorphosed rocks. Criteria have been worked out for locating disturbed zones in certain particular cases of the structure of the medium.

It is known that many mineral resources are associated with buried disruptions, displacements, intrusions and other tectonic dislocations.

Rocks occurring in contact with these are usually so much disturbed and contorted that together with the tectonic dislocations they form single "dislocated zones." Prospecting and tracing of such zones are of great industrial interest.

STARODUBROVSKAYA, S. P. See Berson, I. S.

STAUDER, W., (S.J.), "The Alaska Earthquake of July 10, 1958, Seismic Studies," Bull. Seis. Soc. Am., 1960, Vol. 50, No. 2, pp. 293-322.

VESIAC No. 1929 The instrumental epicenter of the Alaska earthquake of 10 July 1958 has been located on the hanging-wall side of the Fairweather fault near the surface expression of the fault and at the southeast end of the greatly disturbed area.

The fault-plane solution from P waves gives a fault plane which differs by 15° from the strike of the observed surface faulting. The theoretical relative amplitudes computed from the fault-plane solution are interpreted as partly explaining the residuals of P arrivals and inconsistent directions of the first motion of P.

The directions of polarization of the S waves are found to conform to the pattern expected for a single couple as the point-source model of the focal mechanism. A method is suggested for using S waves to check fault-plane solutions from P and to select the fault plane from the two nodal planes of P.

Observations of S at near stations do not correspond to the pattern expected for a couple. Large transverse motion is observed along the azimuth of the fault. In the western United States, at stations along the same azimuth, the SH motion changes progressively to SV with distance. Large SV components at distances of 25° to 27° indicate that the critical angle for SV may be reached at these distances and that even long S waves are refracted by structure within the crust.

STEENLAND, N. C. See Ewing, M.

STEINHART, J. S., and R. P. MEYER, "Minimum Statistical Uncertainty of the Seismic Refraction Profile," Geophysics, 1961, Vol. 26, No. 5, pp. 574-587.

VESIAC No. 929 Interpretation of refraction results leads to finding a model that fits the data as closely as possible. In many cases several plausible models may be postulated. Criteria are then required to evaluate the uncertainty of these models, especially to determine if the data are sufficiently good to distinguish among the models. By expanding the depth function in a Taylor series, a straightforward evaluation of statistical uncertainty may be made. The problems of obtaining estimates of uncertainty for the parameters are discussed, and the method is outlined for estimating uncertainty of the depths. This estimate of the statistical uncertainty is shown to be a minimum, in the sense that it may be said that the uncertainty is at least as large as the estimate.

Finally, the applicability of least-squares procedures to refraction work is discussed, and it is shown that the method of least squares is preferred for the purpose of the minimum estimate.

STEINHART, J. S. See Meyer, R. P.

STESIN, I. M. See Keilis-Borok, V. I.

STETSON, H. T., "The Correlation of Deep-Focus Earthquakes with Lunar Hour Angle and Declination," Science, 1935, Vol. 82, pp. 523-524.

VESIAC No. 1064 Some 2000 earthquakes were investigated in this study. Examination of earthquakes whose foci are more than 100 km below the earth's surface has yielded a striking correlation between the frequency of these deep-focus quakes and the horizontal components of the lunar tidal forces in operation at the time. Data for 122 quakes are given; this selected list includes only those quakes whose focal depth exceeds 100 km and for which an ample number of reliable observations have been secured. The curve of earthquake frequency shows a much closer correspondence to the curve representing the east and west component of the lunar tidal force than to the curve representing the north and south component. While it seems hardly conceivable that the gravitational lunar tidal force could be a major cause of deep-focus quakes, the data here may offer new evidence for the hypothesis of trigger action, or furnish the basis for further speculation on the subject.

STEWART, S. W. See Jackson, W. J.

STUART, D. J., Crustal Structure in Western United States, Part III: Gravity Studies of Crustal Structure, ARPA Order No. 193-61, U. S. Geol. Survey, Denver, Colo., 1962 (OFFICIAL USE ONLY).

VESIAC No. 1127 VU

SUKHODOL'SKI, V. V., "An Apparatus for Recording Inclinations and Accelerations in the Determination of Gravity at Sea," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 11, pp. 1114-1119.

VESIAC No. 1431 The construction of the RNVU apparatus is described. This apparatus records the inclination and acceleration of the mounting of a gravimetric device for determining the gravity at sea. The basic data and characteristics of the apparatus are given.

SULTANOV, D. D. See Kogan, S. D.

SULTANOVA, Z. Z., "Processing of Observations for Earthquakes of Azerbaydzham," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 3, pp. 224-228.

VESIAC No. 1266 The method of time fields was proposed by Yu. V. Riznichenko in 1939 and found wide acceptance in seismic prospecting. This method can be applied in most general cases of structure of media.

In seismology, with the aid of time fields, N. A. Vvedenskaya constricted a family of travel-time curves for P and S waves for depths from 50 to 260 km. He assumed that velocities of waves in the earth's crust are constant, whereas in the layer of ultrabasalt, they change in accordance with a linear law, e.g., $V = V_0(1 + \beta_z)$.

S. S. Andreyev proposed a method of determining the position of foci of local earthquakes, based on the application of time fields. This method was used in studying earthquakes of southwestern Turkmeniya. In this study a many-layered medium of the earth's crust was replaced by a single layer, in which the velocity also changed by the linear law.

In the present article the application of the method of time fields in the conditions of Azerbaydzham is described.

SUTTON, G. H., and C. R. BENTLEY, Topographic Correction Curves, Tech. Rept. No. 3, Lamont Geol. Obs., Palisades, N. Y., 1953.

VESIAC No. 1197
AD 23 444

A set of curves is presented for use in obtaining topographic corrections under conditions likely to be met in seismic-refraction work at sea. The topographic correction is to be used to eliminate deviations from the travel-time curves (caused by variations of the observed topography on the ocean bottom) from the plane surface assumed in the usual methods of reduction.

SUTTON, G., and J. OLIVER, Seismographs of High Magnification at Long Periods, Contribution No. 329, Lamont Geol. Obs., Palisades, N. Y., 1959.

VESIAC No. 1819

Several types of high-magnification seismographs with peak response at periods between about 7 and 80 seconds are operated at the Palisades station of the Lamont Geological Observatory. Comparison of the seismograms from these instruments and of the appropriate theoretical and experimental frequency-response characteristics illustrates their value for the detection and resolution of the long-period components of both body and surface waves. New vertical-component seismographs detect surface waves from small shocks at very great distances and, apparently for the first time, record microseisms in the period range of 10-30 seconds almost continuously.

Two other types of seismographs are operated throughout the world in a cooperative program with other institutions during the International Geophysical Year.

SUTTON, G. H. See Alsop, L. E.; Espinos, A. F.; Pomeroy, P. W.

SUZUKI, Z. See Asada, T.

SWAIN, R. J., "Recent Techniques for Determination of 'In-Situ' Elastic Properties and Measurement of Motion Amplification in Layered Media," Geophysics, 1962, Vol. 27, No. 2, pp. 237-241.

VESIAC No. 1154

The normal method of determining the elastic properties of earth materials is to use static and dynamic tests on core samples. In-

accuracies in this method are caused by the following conditions: (1) overburden stresses are released with resulting change; (2) the core size is often too small for proper coverage; (3) only the more competent cores are recovered for analysis; (4) the physical properties may change in the core; (5) properties of alluvial materials and unconsolidated overburden are difficult to determine; and (6) the effects of anisotropy are difficult to distinguish. A method used for in situ determinations is the generation of waves (at the bottom of a hole) which are recorded by three-component geophones in nearby holes. A setup for earth-tremor measurements in sedimentary layers in San Francisco Bay is described in which three-component seismometers are placed in the different layers.

SWIFT, L. M., "Development of an Earth Velocity Gage," Final Rept., SRI Proj. #SU-2868, Stanford Res. Inst., Menlo Park, Calif., 1960.

VESIAC No. 1133
AD 248 934

Because of the errors inherent in the integration of acceleration records to obtain particle velocity, there is a demand for gauges which measure particle velocity directly, both vertically and horizontally.

The gauges are designed to measure velocities at ranges from nuclear explosions where the particle velocity is from 1 to 60 ft/sec, and where pulse durations are 10 m/sec or more. They are not intended for use on small HE test or in applications where conventional vibration pickups are satisfactory.

The gauges, designed and built in some quantity, have an upper limit of frequency response of about 200 cps, with a lower limit of about 0.1 cps for the horizontal gauge and no lower limit for the vertical gauge (although the latter is limited to about two seconds recording time).

Field tests to date have been inconclusive because of characteristics of the tests, but gauge performance has apparently been satisfactory.

TALWANI, M., B. C. HEEZEN, and J. L. WORZEL, "Gravity Anomalies, Physiography, and Crustal Structure of the Mid-Atlantic Ridge," Pub. Bur. Cen. Seism. Internat. Serie A., Trav. Sci., 1961, Fasc. 22, pp. 81-111.

VESIAC No. 1047

In 1958 a Graf sea gravimeter was used aboard the USS Compass Island to obtain continuous gravity measurements across the Mid-Atlantic Ridge.

The entire Mid-Atlantic Ridge is characterized by small positive free-air anomalies, which for the most part range from zero to +50 mgal. The ridge is thus, apparently, nearly in isostatic compensation, with the departures on the side of under-compensation. Bouguer anomalies are systematically smaller over the ridge than over the ocean basins. Minimum values are found over the crest provinces.

A median rift valley associated with the mid-Atlantic seismic belt was found in earlier work to show a large positive magnetic anomaly. The free-air anomalies on the gravity profile of the USS Compass Island show a 50 mgal minimum over the rift valley. However, this disappears in the Bouguer anomaly, thus showing that it was associated only with the rugged topography.

Assuming a general structure of the ridge based on seismic-refraction studies, three possible sections are presented to show how the structure changes under the crest provinces to provide the necessary isostatic compensation. These structures are discussed in light of the other geophysical anomalies associated with the crest provinces in general and the rift valley in particular.

TAYLOR, D. W. and R. V. WHITMAN, The Behavior of Soils Under Dynamic Loadings, 2: Interim Report on Wave Propagation and Strain-Rate Effect, Rept. No. AFswp-117, Mass. Inst. Tech., Cambridge, Mass., 1954.

VESIAC No. 1167
AD 28 650

Data derived from this investigation are expected to be valuable for the solution of various blast-loading problems. Two important problems are the estimation of strength and settlement characteristics of building foundations subjected to large blast loadings, and the estimation of propagation characteristics of earth shock due to either surface loading or underground explosions. Topics included are the fundamental concepts of compression tests; performance of the rapid-loading machine during very fast tests; unconfined compression tests on Boston clay; vacuum triaxial tests on Ottawa, Fort Peck, and Yucca Flats (AEC) sands; and design of a long triaxial machine for wave-propagation studies. Conclusions concerning strain-rate effects involved the strain-rate effect on compressive strength for cohesive and uncohesive soils and the strain-rate effect upon compressive modulus.

THELLIER, E. and O. THELLIER, "The Intensity of the Earth's Magnetic Field in the Historical and Geological Past," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 9, pp. 929-949.

VESIAC No. 1413

The authors suggest here a method for investigating the remanent magnetization of ancient vases and bricks. These measurements were used for determining the intensity of the earth's magnetic field at the times during which the investigated objects acquired their magnetization. A consistent and steady decrease of the earth's magnetic moment during the past two thousand years becomes evident; in some regions this decrease reaches 65%.

The methods proposed by the authors take into consideration all external influences during the magnetization process, and particularly provide a way of eliminating the effect of repeated heating. This method is the so-called "temperature-cleaning" method.

THELLIER, O. See Thellier, E.

THOMPSON, G. A., "Gravity Measurements between Hazen and Austin, Nevada: A Study of Basin-Range Structure," J. Geophys. Res., 1959, Vol. 64, No. 2, pp. 217-230.

VESIAC No. 1891

From the pendulum base stations at Mystic and Truckee, California, a line of gravimeter stations with side loops was extended eastward through Hazen, Fallon, Eastgate, and Austin, Nevada; it crossed the area displaced by faults in 1954.

Romney's (1957) seismic studies of the 1954 faulting and Whitten's (1957) geodetic measurements agree with direct observations of fault surfaces to indicate a horizontal extension of about 5 feet normal to the trace of the fault. Independent of a strike-slip component of faulting, the region is expanding in area. If the total structural relief was produced by displacements comparable to that of 1954, the extension across Dixie and Fairview Valleys amounts to about 1 1/2 miles in roughly 15 million years; and if this is taken as a fair sample of the Basin and Range Province, the rate of distension in the Province is about 1 foot per century, a rate well within that of historical fault displacements.

At the time of the 1954 faulting, the Bouguer gravity anomaly either did not change or decreased algebraically by an amount no greater than 1.0 mgal.

THOMPSON, R. See Howell, L.

THOMPSON, T. L. and J. B. MISZ, Geologic Studies of Underground Nuclear Explosions RAINIER and NEPTUNE, Rept. No. UCRL 5757, Lawrence Rad. Lab., Livermore, Calif., 1959.

VESIAC No. 143 This report is an analysis of rock changes and displacements resulting from the underground nuclear explosions NEPTUNE and RAINIER within a 2000-foot sequence of moderately folded and faulted Tertiary pyroclastic rocks which overlie Paleozoic limestones and dolomites.

Results of detonations are related to the rock types and to their structural positioning. Gross displacements and fracturing are in apparent accord with the Mohr theory of rupture stress orientation. Primary (blast) and secondary (gravity) stresses have fundamental effects.

The 1700-ton RAINIER explosion was completely contained, thus facilitating definition of results. Collapse of rock materials into the initial cavity, favored by primary shear fractures, defines a 100-foot-diameter cylindrical zone, presumed to extend 188 feet upward from a ground zero. This collapse block has remained essentially intact even though nearly pulverized; radioactive fission products above ground zero were virtually absent.

TIKHONOV, A. N. and O. A. SKUGAREVSKAYA, "The Asymptotic Behavior of the Process of Generating an Electromagnetic Field in a Laminated Medium," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 7, pp. 667-671.

VESIAC No. 1382 In this paper, we consider the asymptotic behavior of an electromagnetic field generated in a medium consisting of several homogeneous and isotropic layers on an insulating base.

TIREY, G. B. See Ewing, J. I.

TOKAREV, V. A., "The Seismicity of the Arctic," Dok. Akad. Nauk SSSR, 1956, Vol. 106, No. 5, pp. 904-906, 1957 (Russian ed.).

VESIAC No. 1028
AD 204 603

The writer notes that the overwhelming majority of Arctic earthquakes occur at a shallow depth. Shocks at middle or great depths are known only in Kamchatka and southern Alaska. For the last 50 years, Arctic seismicity has remained approximately constant; against this uniform background, a series of higher-activity phases has been observed; the intervals between them vary in a nearly regular alternation of long (24-36 months) and short (12-19 months) periods. The most active regions of the Arctic are the Greenland Sea, and southern Alaska plus Kamchatka. For the bulk of the (weaker) Arctic earthquakes, no fixes are obtained by seismic stations because of the great distances of these earthquakes. The author discusses also the seismicity of ancient platforms, of the Caledonian zone, the Hercynian zone, the area around the mouth of the Mackenzie River, the zone of Mesozoic folding, the zone of young Alpine structures, the Okbotsk-Magadan region, and Iceland are discussed. It is concluded that the concept (elaborated 20 years ago) of a single seismically active zone in the Arctic extending from Iceland to southern Alaska does not agree with the conclusions described here.

TOLSTOY, I., "Modes, Rays, and Travel Times," J. Geophys. Res., 1959, Vol. 64, No. 7, pp. 815-821.

VESIAC No. 1937

Relationships between the normal-mode and the ray-optical interpretations of seismic and acoustic measurements are discussed, and applications to the theory and practice of refraction techniques are given. The validity of the ray theory is sometimes open to question; that is, the results of travel-time and intercept measurements may be subject to overinterpretation in terms of rays. Several questions of principle are examined in this connection. It is emphasized that the idea of mode cannot be brought into direct correspondence with the rays and travel times of the optical, approximate approach; and efforts to interpret mode behavior in terms of rays can lead to paradoxical conclusions. This can be understood in terms of the plane-wave, asymptotic nature of such concepts as phase and group velocity.

TOMODA, Y. See Asada, T.

TRYGGVASON, E. and M. BÅTH, "Upper Crustal Structure of Iceland," J. Geophys. Res., 1961, Vol. 66, No. 6, pp. 1913-1925.

VESIAC No. 1883

This report contains the results of the seismic measurements made by a Swedish-Icelandic expedition in Iceland during August and September 1960. This is a continuation of work started a year earlier, and is the first detailed investigation of the deeper structure of the lava beds on Iceland. Measurements were made at eight locations, each with a refraction profile from 20 to 41 km long, in order to obtain values on thickness and structure of the lava layer which covers the whole island. The profiles were laid near a line in a southwest-northeast direction across central Iceland. The lava layer was found to consist of three sections with longitudinal-wave velocities of 3.7 ± 0.3, 4.95 ± 0.2, and 5.55 ± 0.05 km/sec. The 3.7-km/sec section was found mainly in southwest Iceland, where the other two sections were not found. In north Ice-

land the 4.95-km/sec section was found near the surface and the 5.55-km/sec section at a depth of about 2 km. The total lava thickness ranges from 1.73 to 4.81 km; it is thin in the southwest and thick in the northern part of Iceland. Below the lava layers, the longitudinal-wave velocity is about 6.2 km/sec, increasing to 6.7 km/sec at a depth of about 5 km. Shear waves were clearly recorded on three profiles in north Iceland, but were recorded not at all or only faintly on other profiles.

TRYUFIL'KINA, E. I. See Bulin, N. K.

TSEPELEV, N. V., "Reflection of Elastic Waves in a Non-Homogeneous Medium," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 1, pp. 5-8.

VESIAC No. 1318 This paper is a study of the problem of determining the influence of surfaces where there is a discontinuity in the velocity and density gradients on the propagation of elastic waves in non-homogeneous media. It was found that such surfaces reflect the waves. The coefficient of reflection and the refraction index of the waves were obtained, and the change in form (or type of discontinuity at the fronts) of the reflected and the refracted waves, different in type from the incident wave, was established.

TSKHAKAYA, A. D., "The Gegechkori Earthquakes of January 1957," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 8, pp. 23-33.

VESIAC No. 1698 This paper describes a series of earthquakes which took place recently in West Georgia.

TSUBOI, C., Crustal Structure Along a Certain Profile Across the East Indies as Deduced by a New Calculation Method, Contribution No. 818, Calif. Inst. Tech., Pasadena, Calif. (no date).

VESIAC No. 392 The feasibility of a method for calculating the underground mass distribution and the undulation of the geoid is demonstrated by application in the East Indies. This method, which can be extended in such a way as to be applied to three-dimensional cases, is the sin x/x method, originally due to Tomoda and Aki and here presented with some extensions. It is essentially the same as the Fourier series method used by the present author in cases when the domain corresponding to 2π in the Fourier series and the highest order in that series are taken to be very large.

TUCKER, B., "Radio Detections of Space Nuclear Bursts," in Proj. VELA, Proc. of Symposium, ARPA, Washington, D. C., 1960, pp. 217-232 (OFFICIAL USE ONLY).

VESIAC 734-N
AD 253 702

TULINA, YU. V. See Kosminskaya, I. P.

TUNG, T. P. and N. M. NEWMARK, A Statistical Estimate of Relative Distribution of Extreme Shear in a Tool Building Subjected to Random Earthquake Shocks, Tech. Rept. Dept. Civil Eng., Univ. of Ill., Urbana, Ill., 1956.

VESIAC No. 1190
AD 86 662

The method c· random walks was used to obtain a frequency-distributi n function for the st· -y shear developed at different levels of a tall bui ing, simulated by a tall uniform shear beam. The ground mot n an earthquake which shocks the foundation of the structure is a ..d to involve a large number of random pulses, each with equal order of magnitude. Therefore, the state of shear in the structure is the net effect of the shear waves due to the random pulses, which travel from the base to the top and reflect back to the base. The relative distribution of shear was found to be parabolic with respect to the height of the structure. A normal shear distribution is presented for transforming the discrete distribution to a continuous one.

TUVE, M. A. See Tatel, H. E.

TVALTVADZE, G K. See Balabadze, B. K.

TWENHOFEL, W. S., R. A. BLACK, and D. F. BALSINGER, Frequency of Earthquakes for Selected Areas in the Western United States for the Period 1945-59, Rept. No. 782, U. S. Geol. Surv., Denver, Colo., 1961.

VESIAC No. 628

In conjunction with the SHOAL experiment (detonation of a 5-kt underground explosion in a currently active area of shallow-focus earthquakes) the U. S. Geological Survey was authorized to conduct library research to establish a measure of the relative seismicity of possible sites in the minor seismic areas of the U. S. This report presents earthquake-frequency data for the period 1945 to 1959 for the states of California, Nevada, Washington, Montana, Wyoming, Utah, Arizona, and New Mexico, and specifically for 100-square-mile areas in some of these states.

Earthquakes are listed according to location, date, and magnitude. Maps of earthquake epicenters and histograms showing the number of earthquakes of various magnitudes in each year of the periods are included.

U. S. ARMY CORPS OF ENGINEERS (Staff), Underground Explosion Tests, Volume VI: Granite, Unaweep Canyon, Colorado, Appendix A-Geology, Sacramento, Calif., 1949.

VESIAC No. 1170
AD 77 035

The purpose of the investigation was generally to obtain geologic data covering the region in which the test sites were to be located, and more particularly, to obtain detailed geologic information at each individual site. All geologic features were mapped, petrologic field descriptions of the rocks at the site were made, and cores were obtained by diamond drilling. Seismic surveys were made on both sides of Unaweep Canyon in the snow-covered site areas. Further seismic work to determine the field velocities of the specific-site rocks was planned.

Fourteen seismic lines were shot in granite; velocities ranged up to 14,700 fps; lower limits seemed to be about 11,250 fps.

VAILE, R. B., Jr., "Pacific Craters and Scaling Laws," Proc. Geophys. Lab. Cratering Symposium, Part I, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1145-E Crater measurements from two near-surface nuclear explosions detonated at Bikini atoll in 1954 were as follows:

Shot	Location	Approx. Yield (megaton)	Crater Radius (feet)	Est. Max. Depth (feet)
1	reef	1.5	3000	240
3	island	0.1	400	75

On the basis of these and additional crater data from previous nuclear detonations, an extrapolation procedure has been developed by which crater diameters can be predicted. This procedure is based on an empirical determination of the scaling exponent m as a function of soil type, using

$$R = CW^{1/m}$$

where R is radius, C is a constant related to the soil type, and W is the energy release.

The range of uncertainty in the prediction of crater radius by this method is believed to be larger than a factor of 2.

VASIL'EV, also spelled Vassil yev.

VASIL'EV, YU. I., "Study of Alternating Refracted Waves in Seismic Prospecting," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 3, pp. 30-55.

VESIAC No. 1672 The results are described of experiments on the study of alternating refracted waves. The waves discussed are mainly of the $P_{12}S_1$, $P_{123}S_{21}$, $P_{1232}S_1$, . . . types propagating along a refraction boundary as longitudinal waves. Alternating waves of the P_1S_{21}, P_1S_{2321}, $P_1S_{232}P_1$, . . . types, which have passed along the boundary mainly as transverse waves, are also investigated. The intensity of alternating waves has been estimated. Certain particulars of the procedure are explained for discriminating and tracing these waves. The question is discussed concerning the recognition of these waves and determination of the boundaries at which the type of wave alternated (boundaries of alternation).

VASSIL'EV, YU. I., and T. G. IVANOVA, "Filtering Properties of Thin Layers," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 10, pp. 963-969.

VESIAC No. 1611 The relationship between the transmission coefficients of longitudinal and transverse sine waves through a thin layer, on the one hand, and the vibration frequency at various angles of incidence of a wave on a low-

and a high-velocity layer, on the other, is analyzed. (The case of solid media is considered.) The effective attenuation coefficients of elastic waves in an ideally elastic medium containing thin layers are calculated. The effective attenuation coefficients of longitudinal and transverse waves are compared with one another and with the true absorption coefficients known in regard to non-ideally elastic media. Experimental data are given.

VASSIL'EV, YU. I., and M. N. SHCHERBO, "Natural Oscillations in a System: Horizontal Seismograph-Ground," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 11, pp. 1054-1060.

VESIAC No. 1615 The authors study the question of the influence of the seismograph-ground contact during the recording of horizontal and vertical components of ground displacement.

VASSIL'YEV, YU. I., O. I. KOVALEV, and I. S. PARKHOMENKO, "Investigation of the Incompletely Masked Crystalline Basement by the Refracted Wave Method. II," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 5, pp. 323-328.

VESIAC No. 1273 The authors discuss the experimental results given in Part I, and consider some of the dynamic and kinematic characteristics of head waves in the presence of weak velocity differentiation of the medium and incomplete masking. The effects of masking are estimated quantitatively and interpretation of the data is discussed.

VASSIL'YEV, YU. I., O. I. KOVALEV, and I. S. PARKHOMENKO, "Study of the Crystalline Basement by the Refracted Wave Method Under Conditions of Partial Masking. I," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 3, pp. 175-182.

VESIAC No. 1263 A low-frequency modification of the method of refracted-wave correlation has been worked out. A trial is described in which this modified method was used for exploring the crystalline basement under conditions of partial masking. The special features of the low-frequency seismic exploratory apparatus are examined. The characteristics of the experimental findings are given.

VASSIL'EV, YU. I. See Berson, I. S.; Molotova, L. V.

VEITSMAN, P. S., "The Correlation of Seismic Waves in Seismic Depth of the Earth's Crust," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 12, pp. 9-28.

VESIAC No. 1716 The following is an examination of the problem of correlation tracing of seismic waves and wave groups recorded in seismic depth soundings of the earth's crust. Wave groups connected with basic deep seismic boundaries in the earth's crust are isolated on the seis-

mograms. Waves of different groups are distinguished by a number of stable kinematic and dynamic indications. On the basis of analysis of these indications, criteria have been formulated for the separation and identification of wave groups recorded on separate profiles. The principles of such group correlation permit combined interpretation of the seismic traces obtained on profile systems situated hundreds of km from the source, and with inter-profile distances of some tens of km.

VESIAC (Staff), Descriptions of Computer Programs for Seismic Analysis, Rept. No. 4410-17-X, Contr. SD-78, Inst. of Sci. Tech., The Univ. of Mich., Ann Arbor, Mich., 1962.

VESIAC No. 1216 VU This report contains descriptions of 129 computer programs and subroutines which are useful in seismic analysis. Each program is listed according to its originating institution, and includes available descriptive information. A page-number index lists the programs by title.

VESIAC (Staff), Proceedings: Conference on Computer Techniques, Prelim. Rept., Contr. SD-78, Inst. Sci. Tech., The Univ. of Mich., Ann Arbor, Mich., 1961.

VESIAC No. 1800 VU This report is a documentation of the proceedings of the Conference on Computer Techniques, as applied to seismology, held at Pasadena, Calif., 16 December 1961. Fourteen presentations from various seismological institutions involved in the VELA UNIFORM program describe the facilities and programs in use, future plans for data collection and analysis, and general problems of orientation. A general discussion considers theoretical problems and seismic data collection, storage and retrieval, analysis, compatibility, and dissemination procedures. Recommendations are made to the Advanced Research Projects Agency concerning a proposed central Data Analysis Center, a catalogue of formats for magnetic-tape storage of seismic data, and a consideration of standards for seismic-data storage.

VESIAC (Staff), Proceedings of the Colloquim on Detection of Underground Nuclear Explosions, Rept. No. 4410-36-X, Contr. SD-78, Inst. Sci. Tech., The Univ. of Mich., Ann Arbor, Mich., 1962.

VESIAC No. 1808 VU This report presents the proceedings of the Colloquim on Detection of Underground Nuclear Explosions held at the California Institute of Technology, Pasadena, Calif., 14-15 December 1961.

It includes presentations and discussions by representatives of government agencies, universities, and industries. The following basic areas were covered: numerical methods for the improvement of s/n; mechanism at the focus; seismic-wave propagation; depth of focus, epicenter location, and aftershocks; and seismograph development.

VESIAC (Staff), Proceedings of the Conference on Focal Depth Discrimination, Rept. No. 4410-24-X, Inst. Sci. Tech., The Univ. of Mich., Ann Arbor, Mich., 1962 (OFFICIAL USE ONLY).

VESIAC No. 1207 VU

VINNIK, L. P., "Low-Frequency Seismometer Arrays," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 5, pp. 421-423.

VESIAC No. 1564 The seismometer-array method can be used for a wide range of problems which have to be solved by seismology. A formula is deduced for magnification and frequency characteristic of a seismometer in an array with direct galvanometric registration. A method of computing arrays for certain areas is given.

VINOGRADOV, S. D., "Acoustical Observations in Shafts of the Kizelsk Coal Basin," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 6, pp. 60-73.

VESIAC No. 1687 A description is given of the results of observations of acoustic (elastic) impulses occurring as a result of mountain pressure in the shafts of the Kizelsk coal basin. The acoustic impulses were recorded on magnetic film which was later processed in the laboratory. The following characteristics of the impulses were studied: noise (repetition frequency), intensity, form and frequency spectrum. It was found that the intensity (power) of the acoustic phenomena was the characteristic which behaved the most significantly; the frequency spectrum of elastic impulses depends on their magnitude. The spectrum structure varied at different times. The observations of acoustic impulses were carried out, in conjunction with investigations of the mountain pressure, with the aid of a supersonic seismic-impulse method.

VIOLET, C. E., "A Generalized Empirical Analysis of Cratering," Proc. Geophys. Lab. Cratering Symposium, Part I, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1145-I A general empirical analysis of chemical and nuclear explosive cratering is presented. This analysis makes use of the concepts of efficiency and scaling formalism. Efficiency is assumed to depend on type of explosive, medium, and depth of burst. Scaling formalism is generalized in terms of experimentally determined yield exponents associated with each pertinent dimension. Experimental procedures are specified to determine the efficiency and yield exponents.

With these methods applied to chemical-explosive cratering data in desert alluvium, the crater-radius and depth-yield exponents are both $\frac{1}{3.4}$. The standard deviation is 3%. The depth-of-burst yield exponent is $\frac{1}{3.6}$ with a standard deviation of 3%. Thus the principle of similitude is not rigorously obeyed. Assuming nuclear craters are best described by the above exponents, one can determine the percent efficiency of nuclear cratering in desert alluvium as follows:

	Based on Crater Radius		Based on Crater Depth	
JANGLE S	2.6	1.2	4.6	2.1
JANGLE U	78	35	146	66
TEAPOT ESS	43	19	208	94

This behavior of the efficiency indicates that the relative contribution of various crater-forming mechanisms differ in chemical and nuclear cratering. Therefore, the cratering capabilities of nuclear explosives cannot be related to those of chemical explosives by means of a single parameter.

The prediction of nuclear crater dimensions from data obtained from low-yield chemical explosives is examined.

VIOLET, C. E., "Source Measurements for Projects LOLLIPOP and DRIBBLE," Proj. VELA, Proc. of Symposium, ARPA, Washington, D. C., 1960, pp. 151-166 (OFFICIAL USE ONLY).

VESIAC No. 734-I
AD 253 702

VITOUSEK, M. J. See Mason, R. G.

VOGEL, A. A., "Automatic Equipment at the Seismic Stations of the North-Tien-Shan Zone," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 2, pp. 154-158.

VESIAC No. 1473 This paper submits a description of the equipment installed at the seismic stations of the North-Tien-Shan zone intended for the automatic increase of the filament voltage, introduction of a multistage scale compression device ("zagrublenie"), and a warning system during the recording of earthquakes.

VOLAROVICH, M. P., and D. B. BALASHOV, "Investigation of Elastic Wave Velocities in Rock-Samples Under a Pressure of Up to 5000 kg/cm^2," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 3, pp. 56-69.

VESIAC No. 1674 This paper describes the apparatus and procedure for laboratory measurements of the elastic velocity of longitudinal ultrasonic waves in rock samples under high all-round pressures of up to 5000 kg/cm^2. Results are given for longitudinal wave velocities in samples of certain igneous and sedimentary rocks. The results obtained are discussed.

VOLAROVICH, M. P., D. B. BALASHOV, and V. A. PAVLOGRADSKY, "Study of the Compressibility of Igneous Rocks at Pressures up to 5000 kg/cm^2," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 5, pp. 486-492.

VESIAC No. 1369 This paper describes the apparatus and laboratory methods for measuring the linear compressibility of rock specimens at high uniform pressures of up to 5000 kg/cm^2. It gives the results of measurements

of isothermal linear compressibility on specimens of some igneous rocks. From the linear-compressibility data, the authors compute the isothermal volumetric compressibility, the isothermal modulus of volumetric compression, and the density of the investigated rocks within the pressure range mentioned above. A discussion of the experimental results is included.

VOLAROVICH, M. P., and A. S. GURVICH, "Investigation of Dynamic Moduli of Elasticity for Rocks in Relation to Temperature," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 4, pp. 1-9.

VESIAC No. 1675 Using the resonance method of transverse vibrations of rods, the writers have determined Young's modulus and damping decrement at temperatures up to 1000°C for a number of rock specimens. Young's modulus for granites decreases to 1/6 up to 600° and remains nearly constant with further rise up to 900°. Elastic moduli of basalts are less affected by heating. In the region of high temperatures, a considerable increase of damping decrement is found in rocks. Sandstone and quartzite show a minimum Young's modulus and maximum damping decrement at 575°, a fact explainable by the polymorphous transformation of quartz. With these data, the velocities of longitudinal waves in rocks are calculable up to 1000°.

VOLAROVICH, M. P. See Stakhovaskaya, Z. I.

VOL'VOVSKI, B. S. See Godin, Ya. N.

VOL'VOVSKI, I. S. See Godin, Ya. N.

VORTMAN, L. J., "High-Explosive Craters in Tuff and Basalt," Proc. Geophys. Lab. Cratering Symposium, Part I, Rept. No. UCRL-6438, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 1145-H Thirteen 256-pound charges of spherically cast TNT were detonated in volcanic tuff to determine the apparent crater dimensions. Charges were placed at six different burst depths in the region approaching containment of the explosion. Variation of crater dimensions with burst depth was determined. No crater resulted where scaled burst depth was greater than 1.75 ft/$W^{1/3}$. (W is charge weight in pounds.) Ten 1000-pound charges (two at each of five burst depths) and three 40,000-pound charges (each at different burst depths) described variation of crater dimensions with burst depth in basalt. No departures from cube-root scaling are detectable. For constant charge size, maximum and average rock sizes increase with increased burst depth. For constant scaled burst depth, maximum rock size increases as charge weight is increased. Cylindrical charges give larger craters than spherical charges at deeper burst depths and smaller craters at shallower burst depths. Mass of ejected dust has been related to apparent crater volume. The amount of blast suppression with charge burial is shown.

VVEDENSKAYA, A. A., "The Displacement Field Associated with Discontinuities in an Elastic Medium," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 4, pp. 357-362.

VESIAC No. 1350 The dynamic displacement field in an isotropic and homogeneous elastic half-space is determined for cases of instantaneous disruption of the continuity of the medium and with given dislocation faces. The solution is based on Volterra's theory of dislocation: the stresses removed from the rupture face at the moment the rupture occurs are determined. The results obtained can be used in studying the stresses and ruptures at earthquake foci.

VVEDENSKAYA, A. V., "Determination of the Stresses Active in the Foci of Earthquakes, Based on Observations at Seismological Stations," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 4, pp. 341-344.

VESIAC No. 1483 A model of the fault forces, as established by the dislocation theory, is used for studying the stresses effective in the focus prior to the disruption of the continuity of the medium, and which are then released at the moment of the break. A method for determining these directions from the recordings of two or more seismological stations is introduced.

VVEDENSKAYA, A. V., "Special Features of the Stressed State in Foci of Earthquakes in the Baikal Region," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 5, pp. 432-434.

VESIAC No. 1566 The results of a study of the stresses acting at the focus of the earthquake of 29 August 1959 show that the principal axes in the central Baikal area correspond to the predominant direction of these axes in the northeastern and southwestern Baikal area; that is, for the Baikal region as a whole, there are dominant directions of the principal axes.

VVEDENSKAYA, A. V., and L. M. BALAKINA, "Double Refraction in the Earth's Mantle," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 8, pp. 814-819.

VESIAC No. 1397 Observations of the field of displacement of longitudinal (P) and transverse (SV, SH) waves propagating in the mantle of Earth disclose an increase in the amplitudes of P and of SV in relation to SH waves during the penetration of seismic rays to the depths of 250-500, 900-1000, 1200-1300, 1800, and about 2200 kilometers. These peculiarities of the displacement field may be connected with a polarization of the transverse waves during double refraction in the anisotropic layers (which correspond to the depths enumerated above) of the earth's mantle.

VVEDENSKAYA, A. V., and L. RUPREKHTOVA, "Characteristic Features of Stress Distribution in the Foci of Earthquakes at the Bend of the Carpathian Arc," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 7, pp. 629-636.

VESIAC No. 1586 An analysis of the stress distribution in the foci of earthquakes at the bend of the Carpathian arc has shown that the compressive stresses

in that region are directed almost parallel to the horizontal plane and act normally to the Carpathian arc; the tensile and intermediate stresses lie in a plane whose line of intersection with the earth's surface is tangent to the arc and coincides in its strike with the axes of the observed folds in that region. The result obtained shows the uniformity of the tectonic structure of the region from the earth's surface down to a depth of at least 150 km, where the foci of the earthquakes occur. It further follows from the analysis that in the foci of the earthquakes the same forces are active which had determined the relief and tectonic geology of the region.

VVEDENSKAYA, N. A., "Instrumental Observations of Weak Earthquakes as a Basis for the Establishing of Seismic Regions," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 2, pp. 118-125.

VESIAC No. 1257 The writers analyze seismic recordings of earthquakes in Central Asia from 1950 to 1955, compare these with data obtained from large earthquakes prior to this, and conclude that a geographic relationship exists between the occurrence of weak earthquakes during recent years and that of large earthquakes during a longer period of time. More recent data of weak earthquakes may therefore be used to establish regional seismic divisions for the purpose of singling out epicentral areas and zones of seismic activity.

WADATI, K., "Shallow and Deep Earthquakes," Geophysics Mag. (Tokyo), 1928, Vol. 1, pp. 162-202.

VESIAC No. 1088 The author discusses various ways that have been used to estimate the focal depth of earthquakes. Assuming that both P and S waves are generated at the focal point of the earthquake, and that these waves are propagated with constant, but different, velocities, the author uses the difference of wave arrival times to calculate the depth of focus. Maps of iso-arrival times of P waves and of iso-differences of P and S arrival times indicate not only the epicenter but the depth of focus; the greater the difference between the arrival times of P and S, the deeper the focus. Using various values of velocity of P and S, the author calculates the focal depth of the deep earthquake of 27 July 1926 as approximately 340 km. Deep earthquakes occur at depths of 300 km or more and are relatively rare. Calculations indicate the velocity of P and S wa es may increase more rapidly with depth than previously supposed. Zones of deep-focus earthquakes in Japan are mapped.

WADSWORTH, G. P., and E. A. ROBINSON, A Prospectus on the Applications of Linear Operators to Seismology, MIT GAG Rept., Mass. Inst. Tech., Cambridge, Mass., 1952.

VESIAC No. 1108 This report discusses, in connection with the probabilistic approach in seismology, the science of exploration seismology, basic problems, the introduction of statistical methods in seismology, the relation of statistical information to geologic information, and the relation of the deterministic and probabilistic approaches. Concerning the theory of stationary time series, the following are discussed: the linear operator,

the relation of the autocorrelation and the spectrum, the relation of the linear operator and the autocorrelation, the relation of the linear operator and the cross-correlation, the cross-spectrum, and last, the relation of the cross-correlation and the spectra.

WALDNER, N. G., and E. F. SAVARENSKY, "On the Nature of the Lg_1 Wave and of its Propagation in Northeast Asia," Bull. Acad. Sci. USSR, Geophys. Ser., 1961, No. 1, pp. 1-12.

VESIAC No. 1538 The presence of Lg and Rg waves in the northeast of the USSR is revealed. Their existence in the continental crust of the earth is demonstrated. Some considerations are adduced on the nature of the Lg_1 wave.

WALKER, G. R. See Herzberg, G.

WALKER, G. W., "The Problem of Finite Focal Depth Revealed by Seismometers," Roy. Soc. Phil. Trans., London, Ser. A., 1922, Vol. 222, pp. 45-56.

VESIAC No. 1731 Observations of the emergence angle of P waves at Pulkovo suggest that the focal depth is approximately one-fifth of the earth's radius. It is shown that important modifications have to be made in the interpretation of seismograms and in the attempt to determine the relation of depth and propagation speed. It is further shown that an important test of the accuracy of the Pulkovo values can be made by a careful scrutiny of seismograms for distances > 11,000 km. Further progress cannot be made until this research has been carried out and until we have corresponding measures, by three component seismometers, of the angle of emergence of S waves.

WEBER, J. See Forward, R. L.

WELLS, W. M., et al., Project San Andreas, Aftershock Recordings, Quincy Earthquake of November 18, 1960, Tech. Rept. No. 2, Stanford Res. Inst., Menlo Park, Calif., 1961.

VESIAC No. 990 Three seismic units monitored aftershocks of the Quincy earthquake (11:43:14 GCT, 18 November 1960; magnitude = 4.4) for about 96 hours beginning 38 hours after the quake. Only one aftershock was recorded; it occurred at 17:18:50 GCT 21 November, and it ariginated near the earthquake's epicenter. The average velocity of the seismic wave was 6.3 km/sec.

Several landslides which occurred in the Feather River canyon on the morning of November 18 may have been triggered by the earthquake. These were the only observable terrain effects.

WELLS, W. M., W. H. WESTPHAL, A. L. LANGE, and G. S. BRINK, Project San Andreas, Aftershock Recording, Hollister Earthquake of October 22, 1960, Tech. Rept. No. 1, Stanford Res. Inst., Menlo Park, Calif., 1961.

VESIAC No. 989 Aftershocks of the Hollister earthquake (7:43 P. M. PST, 22 October 1960; magnitude = 3.8) were recorded by three seismic units for 76 hours beginning 28 hours after the quake. Of 11 events recorded simultaneously by all three units, seven were fairly strong aftershocks, three were probably weak aftershocks, and one was a sonic boom.

Two aftershocks originated near the earthquake's epicenter. Others are interpreted as general movements and adjustments.

The predominant frequency of the aftershock seismic waves varied appreciably, perhaps in relation to depth and distance. Velocities in excess of expected seismic velocities imply signal arrival from steep angles and considerable depth. Data were insufficient to determine the frequency of occurrence of aftershocks with time.

Pre- and post-earthquake magnetic surveys showed no variation in the vertical component of the magnetic field.

There were no observable geologic or terrain effects from the Hollister earthquake.

WELLS, W. M., W. H. WESTPHAL, A. L. LANGE, and G. S. BRINK, Project San Andreas Aftershock Recording, Antioch Earthquake of December 15, 1960, Tech. Rept. No. 3, Stanford Res. Inst., Menlo Park, Calif., 1961.

VESIAC No. 991 Aftershocks of the Antioch earthquake (05:30:26 GCT, 15 December 1960; magnitude = 3.9) were monitored for 138 hours beginning 21 hours after the quake. Of 20 events recorded, 15 were caused by passing aircraft, three were aftershocks, and one was a distant earthquake (23:23:30 GCT, 18 December 1960; magnitude = 4.1). The one additional event was recorded at only one unit, its wave velocity was unusually low (3.7 km/sec), and its origin or cause could not be determined.

The three aftershocks occurred along a line from 4.5 to 19.0 miles to the northwest of the earthquake's epicenter. The average velocities of the seismic waves ranged from 6.5 to 7.4 km/sec. These rather high velocities indicate arrival from considerable depth.

There were no observable terrain effects from the Antioch earthquake.

WELLS, W. M., W. H. WESTPHAL, A. L. LANGE, and G. S. BRINK, Project San Andreas, Aftershock Recording, Watsonville Earthquake of January 3, 1961, Tech. Rept. No. 4, Stanford Res. Inst., Menlo Park, Calif., 1961.

VESIAC No. 992 Aftershocks of the Watsonville earthquake (First Shock: 23:00:21 GCT, 3 January 1961, magnitude = 3.6; Second Shock: 00:30:17 GCT, 4 January 1961, magnitude = 4.1) were recorded by three seismic units for 142 hours beginning about 24 hours after the 4.1-magnitude (primary) event. Of 17 events recorded simultaneously by two or all three units, five were found to be aftershocks of the primary event on a basis of their proximity (within 20 km) and their having originated in the same fault complex as the primary event.

Refraction phenomena along the faults in the area interfered with accurate determination of epicenter locations. Knowledge of the geology of the area permitted estimated corrections of error in locating epicenters of some events.

General seismic activity in the area made it difficult to separate aftershocks from unrelated seismic events. Records from the University of California's Vineyard Station showed about the same number of events for four days prior to the earthquake as for four days after the monitoring period.

There were no observable geologic or terrain effects from the Watsonville earthquake.

WERTH, G. C., F. H. ROLAND, and D. L. SPRINGER, The Calculations of Amplitudes of First Arrivals of Seismic Waves from Underground Nuclear Explosions, Rept. No. UCRL 6627, Lawrence Rad. Lab., Livermore, Calif., 1961.

VESIAC No. 682 Theoretical waveforms for the first cycle and a half are calculated for Romney's experimental recordings of underground nuclear explosions BLANCA, LOGAN, and TAMALPAIS in the range 96 to 714 km. Models of the crust are constructed from travel time. Zvolinskii's near-front approximation is used to form the basis of amplitude calculations which include head coefficients, geometrical spreading, and corrections for superposed layers. The source function is scaled up from measurements made of RAINIER. The effects of attenuation and instrument response are included. By convolving these factors, theoretical displacement amplitudes are calculated in $m\mu$ for the first half cycle; these agree with the experimental measurements of LOGAN and BLANCA from 300 to 600 km within +40 to 16%. A single-layer crustal model with a Q of about 400 is indicated by the amplitude calculations. The amplitude of later half cycles are influenced by the reflection of interaction at the surface of the Rainier Mesa. Additional data and calculations have indicated that the surface reflection or interaction is nonlinear, and has an amplitude about three times higher than that expected on an elastic basis.

WESTERBERG, H. See Langfors, U.

WESTPHAL, W. H. See Wells, W. M.

WHITEWAY, F. E., Tuned Seismometer Arrays, Field Experiments Division Note No. V5, United Kingdom Atomic Energy Authority, Blacknest, Brimpton, Nr. Reading, Berkshire, 1961 (OFFICIAL USE ONLY).

VESIAC No. 671

WHITMAN, R. V. See Taylor, D. W.

WILLIS, D. E., and J. T. WILSON, "Effects of Decoupling on Spectra of Seismic Waves," Bull. Seis. Soc. Am., 1962, Vol. 52, No. 1, pp. 123-131.

VESIAC No. 898 A series of controlled high-explosive shots were conducted by the Atomic Energy Commission in a salt mine near Winnfield, Louisiana, to investigate seismic decoupling theories. Two recording stations were used by The University of Michigan at various distances between 1.1 and 14.7 km for a majority of these shots. Frequency analyses of the magnetic-tape recordings were made; they show the relationship of the frequency spectra as a function of charge size, distance from the source, and coupled vs. decoupled shots. The smaller decoupled shots detonated in the large spherical cavities were observed to have somewhat higher predominate frequencies than the same sized coupled shots. A change in cavity size produced no significant difference in the shape of the spectra of the large decoupled shots.

WILLIS, D. E. See De Noyer, J.; Frantti, G. E.

WILLMORE, P. L., "The Application of the Maxwell Impedance Bridge to the Calibration of Electromagnetic Seismographs," Bull. Seis. Soc. Am., 1959, Vol. 49, No. 1, pp. 99-114.

VESIAC No. 1787 The writer shows that an electromagnetic seismography may be calibrated by observing the deflections of the galvanometer when an electrical signal is injected through a suitable coupling circuit. A specially designed version of the Maxwell Impedance Bridge is used for this purpose; the seismometer is connected in one arm and the galvanometer across the output. The bridge is balanced when the seismometer is clamped. The seismometer is then unclamped, and the galvanometer starts to swing with an amplitude equal to that which would be produced by a ground acceleration proportional to the bridge current. The constant of proportionality is found by injecting a "substitution emf" across the ratio arm of the bridge. By carrying out the substitution experiments in their most complete form, one can determine the mass, the suspension stiffness, and the damping constant of the seismometer—either including or excluding the effects of the galvanometer reaction. Typical calibration curves for Benioff, Willmore, and Sprengnether seismometers are included.

WILLMORE, P. L., "The Detection of Earth Movements," Methods and Techniques in Geophysics, Dominion Observatory, Ottawa, Ont., no date.

VESIAC No. 1150 This document discusses the representation of the seismograph response, the theory of pendulum seismographs, seismographs measuring stress or strain, and the further development of seismometry. In connection with the theory of pendulum seismographs, the following items are discussed: the direct-coupled pendulum seismograph, moving-coil seismographs, the variable-reluctance seismometer, calibration of pendulum seismographs, and practical details of some pendulum seismographs.

WILLMORE, P. L., "The Use of the Stereographic Net for the Rapid Approximate Determination of Distance and Azimuth," Earthquake Notes, 1957, Vol. 28, pp. 4-6.

VESIAC No. 922 The distance and azimuth from a seismograph station to earthquake epicenters anywhere in the world may be determined simply and rapidly by means of a stereographic chart bearing a suitable family of reference circles. Base charts designed for this purpose are obtainable from the Dominion Observatory, Ottawa.

WILSON, J. T., "Underground Shocks," Internat'l Sci. & Tech., 1962, pp. 46-53.

VESIAC No. 1801 To identify underground nuclear explosions, seismologists must distinguish them from natural earthquakes which occur daily. Differences in the stress geometry of the two shock sources are reflected in different geographic patterns of initial ground motion, varying amounts of certain of the seismic waves produced by the shock, and distinctive distribution of frequencies in the respective elastic-wave spectra. But these and other discriminating differences are distorted by dispersion, scattering, filtering, and absorption of the seismic wave trains along their complex path from source to seismograph through the heterogeneous earth. Also, "microseismic" noise obscures the seismographic recording of the essential, but weak, residual signals.

Seismologists are leading a $14 1/2-million government-sponsored program, VELA UNIFORM, that seeks to better seismic detection methods. Promising directions for improving s/n include using arrays of seismographs, and placing seismographs in deep wells and on the deep-sea floor, away from noise. Fundamental help will come from upgrading existing seismic stations, and from extending station networks; these improvements will clarify path effects and greatly refine the statistical bases for identification.

WILSON, J. T. See De Noyer, J.; Frantti, G. E.; Willis, D. E.

WINCKLER, J. R., and L. PETERSON, "Auroral X-Rays, Cosmic Rays and Related Phenomena During the Storm of Feb. 10-11, 1958," J. Geophys. Res., 1959, Vol. 64, No. 6, pp. 597-610.

VESIAC No. 1913 Balloon observations were made during the auroral storm of 10-11 February 1958 at Minneapolis. Strong x-ray bursts in two groups were detected. The groups appeared coincident with two large magnetic bays, with strong radio-noise absorption, and with the passage across the zenith of a very large amount of auroral luminosity. The x-ray intensity and measured energies showed an electron current of 0.6×10^6 electrons/cm^2/sec to be present. These electrons ionizing the upper D layer accounted for the increased cosmic-noise absorption. The x-rays themselves carried 1000 times less energy than the electrons and could not provide sufficient ionization for the observed radio absorption. Visual auroral forms during this storm are reported to have lower borders at the 200-300-km level. There is thus a difficulty in bringing the electrons to the D layer without an accompanying visible aurora. A cosmic-ray decrease accompanied the storm and was observed to be from 4 to 6% at sea level, 21% in the balloon altitude ionization, and 15% in total energy influx at 55° geomagnetic latitude. Compared with the

great intensity of the magnetic and auroral phenomena in this storm, the cosmic-ray modulation was not exceptionally large.

WOOD, H. O., "A Chronologic Conspectus of Seismologic Stations," Bull. Seis. Soc. Am., 1942, Vol. 32, No. 2, pp. 97-159.

VESIAC No. 428 This chronological conspectus of seismologic stations throughout the world contains relevant data arranged in tabular form.

WOOD, H. O., and N. H. HECK, Earthquake History of the United States, Part II, Rept. No. 41-1, U. S. Gov't Printing Off., 1961.

VESIAC No. 1160 This publication describes the stronger earthquakes that occurred in California and western Nevada through 1960. In this revised edition, corrections and additions have been made to the text of the 1951 edition. The descriptions, though concise, present the important known facts concerning each earthquake: its year, day, hour, locality, latitude, longitude, area (in square miles), and intensity. The earliest quake listed occurred in the Los Angeles region in 1769; the last off Cape Mendocino in 1960. In sections following the tabular listing of earthquakes, descriptive details are given for major quakes and for intermediate and minor quakes.

WOOLLARD, G. P., "Crustal Structure from Gravity and Seismic Measurements," J. Geophys. Res., 1959, Vol. 64, No. 10, pp. 1521-1544.

VESIAC No. 1888 Gravity data indicate that there is a regular relationship between crustal structure, crustal density (composition), and surface elevation. Earthquake and surface seismic refraction and reflection evidence of the composition and structure of the earth's crust have not shown a simple relationship to the surface elevation. The velocity dispersion of earthquake surface waves, on the other hand, indicates variations in the thickness and composition of the crust that are in general accord with the variations in surface elevation and the Bouguer gravity anomalies. The fact that seismic-refraction measurements have not agreed everywhere with gravity and surface-wave indications of crustal structure appears to be a result of masking of crustal layering. On the basis of the slope of the curve that describes the relationship between the seismic depth to the Mohorovicic discontinuity and Bouguer gravity anomalies, the density difference between the crust and the mantle appears to decrease as the thickness of the crust increases.

On the assumption that the mantle has a constant mean density of 3.32 gm/cc, the mean crustal density would appear to increase from a minimum value of 2.86 gm/cc in the oceans to about 3.08 gm/cc beneath the high plateaus and mountains. If the mean crustal density is essentially constant, the effective density of the mantle must decrease by a comparable amount. The existence of a low-density zone in the upper part of the mantle, as suggested by the velocity dispersion of very-long-period Rayleigh waves, would explain the relationships observed. Isostatic relationships suggest that the mean density of the continental crust is essentially constant (2.85 gm/cc to 2.88 gm/cc). These values imply that a basaltic layer is present everywhere. USSR studies in

Central Asia have suggested an increase in mean crustal density as the crust thickens. The studies show that the intermediate (basaltic) layer is usually thicker beneath areas of uplift. Although the origin of the basaltic layer can only be surmised, its general inhomogeneity, as indicated by variations of seismic velocity from 6.4 to 7.3 km/sec, and its varying thickness suggest that it may be a zone of phase transformation within the underlying mantle rock. Despite the lack of homogeneity in the crust, empirical relationships may possibly be used to predict approximate crustal thickness from the regional Bouguer gravity anomalies or from surface elevations, with a reliability approaching that for seismic measurements.

WOOLLARD, G. P., Seismic Studies in the Southern Half of the Atlantic Coastal Plain, Tech. Rept., Dept. of Geology, Univ. of Wisc., Madison, Wisc., 1954.

VESIAC No. 1198
AD 24 735

Seismic measurements were made at 57 locations in the Atlantic Coastal Plain to determine the depth of sediments overlying the pre-Cretaceous erosion (basement rock) surface. The surface-profile-shooting method was employed to determine true velocities for the seismic discontinuites encountered and the dip of each seismic-discontinuity surface. Surface-rock velocity determinations were obtained to ascertain velocity values of the basement surface rock. The results confirmed the presence of 3 seismic horizons above the surface which were characterized by velocities of 2600 to 4000 ft/sec, 5700 to 6800 ft/sec, and 7000 to 8000 ft/sec. The first 2 horizons occurred at nearly every station, but the third was found only when the depth of the sediment was greater than 400 feet. The upper seismic discontinuity probably represented the position of a water table; a transition in velocity occurred from partially water-saturated sediments to completely water-saturated sediment. The basement included diverse rock types ranging from Triassic sandstones and shales to granites, schists, and gneisses.

WOOLLARD, G. P., W. E. BONINI, and R. P. MEYER, "A Seismic Refraction Study of the Subsurface Geology of the Atlantic Coastal Plain and Continental Shelf Between Virginia and Florida," Tech. Rept., Dept. of Geology, Univ. of Wisc., Madison, Wisc., 1957.

VESIAC No. 1201
AD 151 204

Seismic-refraction measurements were made to study the subsurface geology and the configuration of the basement rock surface beneath the Atlantic Coastal Plain lying between Virginia and Florida. The fundamentals of seismic refraction are reviewed and the general observational procedures used are described for: land seismic measurements; marine measurements and operations, including operational notes, detection of signal and recording, range and azimuth control, geographic position, and winds, sea, and weather. Auxiliary studies having a bearing upon the interpretation of the present seismic study included: (1) an earthquake-epicenter distribution map, (2) a Bouguer gravity anomaly map, (3) gravity and magnetic profiles, (4) previous seismic data, and (5) subsurface geologic studies based on well data. The seismic data were reduced into time-travel plots, structural profiles, structural cross-sections, and pre-Cretaceous basement con-

figurations. The data were used in describing the lithology, stratigraphy, current and past tectonic activity, and character of the basement rocks.

WOOLLARD, G. P. See Meyer, R. P.

WORZEL, J. L., and M. EWING, "Explosion Sounds in Shallow Water," in Propagation of Sound in the Ocean, Geol. Soc. Am., New York, N. Y., 1948.

VESIAC No. 1030 This article describes seismic investigations of various water-covered areas by the refraction method. These areas were chosen for their diverse geologic columns. The instrumentation allowed analysis of frequencies from 10 to 10,000 cps. Intensity measurements of the various frequencies were also made. Recordings were made by means of geophones and hydrophones for sound receivers.

WORZEL, J. L., and G. L. SHURBET, "Gravity Interpretations from Standard Oceanic and Continental Crustal Sections," in Crust of the Earth (A Symposium), Spec. Paper 62, Geol. Soc. Am., New York, N. Y., pp. 87-100, 1955.

VESIAC No. 1040 Standard continental and sea sections have been determined from seven continental seismic profiles believed to be the best where gravity and elevation information is also available, and six oceanic seismic stations where gravity data are available.

The sections obtained are 33 km of crustal rock (density 2.84) overlying the mantle for the standard continental section, 5 km of sea water, 1 km of sediments, and 4.5 km of crustal material overlying the mantle for the standard sea column.

Using these standard columns, the writers discuss and deduce the probably structures of the Puerto Rico Trench, the great deeps such as the Mindanao Deep, the Gulf Coast geosyncline, and the Bahamas Platform.

WORZEL, J. L. See Ewing, M.; Talwani, M.

WUENSCHEL, P. C. See Officer, C. B.

YAMAMOTO, R., "The Microbarographic Oscillations Produced by the Explosions of Hydrogen Bombs in the Marshall Islands," Bull. Am. Meteorol. Soc., 1956, Vol. 37, No. 8, pp. 406-409.

VESIAC No. 2012 This report treats of the pressure oscillations due to the hydrogen-bomb explosions in the Marshall Islands. The records of routine barographs at the fourteen stations in the Pacific territory were examined and the following facts were disclosed: (1) no trace of the oscillation could be detected on the barograms at the stations located nearly to the west of the explosion site, in spite of the comparatively close dis-

tance; (2) the speed of the wave propagating eastwards was higher than that of the westward wave by about 50 m/sec.

YANOVSKAYA, T. B., "The Dispersion of Rayleigh Waves in a Spherical Layer," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 7, pp. 461-467.

VESIAC No. 1283 The author examines Rayleigh waves caused by a sinusoidal point source on the free boundary for the case of a spherical layer covering an elastic sphere. He shows that for high frequencies in a thin layer, the dispersion curves for a plane and a spherical layer differ by a magnitude of the order of λ/R.

YANOVSKAYA, T. B., "An Investigation of Dispersing Surface Waves in the Region of Minimum Group Velocity," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 12, pp. 1234-1237.

VESIAC No. 1444 An asymptotic expression is obtained for the displacement in dispersing surface waves. The expression is valid in a rather wide region in the neighborhood of the minimum group velocity. The writer shows that this expression includes both the result obtained by the stationary-phase method and the expression for the Airy phase. A formula is given for the first correction term. As an example of the application of the formulas obtained, seismograms are calculated near the minimum group velocity for several amplitudes.

YANOVSKAYA, T. B., "On the Determination of the Dynamic Parameters of the Focus Hypocenter of an Earthquake from Records of Surface Waves. I," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 3, pp. 161-167.

VESIAC No. 1261 The author derives formulas for displacements of Rayleigh and Love waves in a layer lying on top of an elastic semi-infinite space produced by a stationary concentrated source. This source is of the type of a dipole with a torque within the layer.

YEN, K. T. See Lieber, P.

YULE, T. J. See Birkenhauer, H. F.

ZAIEV, L. P., and N. V. ZVOLINSKI, "Study of the 'Head Wave' Developed at the Interface Between Two Elastic Fluids," Bull. Acad. Sci. USSR, Geophys. Ser., 1951, Vol. 15, No. 1, pp. 20-39.

VESIAC No. 1193
AD 39 435 The authors set forth the dynamic characteristics of the head wave which is formed when a wave with a non-planar front falls on an interface between two elastic media. The properties of this wave are valuable in the interpretation of seismic observations. The head wave was investigated by the method of functional-invariant solutions proposed by V. I. Smirnov and S. L. Sobol'yev, under the assumptions of plane-polarized vibrations and a planar interface between the media. For the vibrations a point source, typical of a center of propagation, was assumed.

ZAIONCHKOVSKII, M. A. See Aksenovich, G. I.

ZAITSEV, L. P., "On Degenerated Head Waves in an Elastic Medium with an Interface," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 8, pp. 744-747.

VESIAC No. 1498 The paper analyzes an axially symmetric problem of forced oscillations in a medium consisting of two elastic half spaces with a plane interface. For the case of liquid-media, the author identified oscillations of this type from a general solution in an earlier article. Their existence was previously pointed out by Cerveny.

ZAWICKI, I. See Nalecz, M.

ZHARKOV, V. N., "On the Thermal Conductivity Coefficient of the Earth's Mantle," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 11, pp. 776-780.

VESIAC No. 1309 A detailed study of the thermal-conductivity coefficient of the earth's mantle was made. This coefficient is composed of two parts: the crystal-lattice component attributable to the usual mechanism of thermal conductivity in crystals (i.e., the diffusion of the thermal excitations of phonons); and the radiation component related to the transfer of heat by infrared electromagnetic vibrations.

A formula was derived for the crystal-lattice part of the thermal-conductivity coefficient; the formula denotes the coefficient's dependence on temperature and pressure. The article shows the computation of the radiation part of the thermal-conductivity coefficient developed on the basis of the kinetic theory of gases. The study indicates the qualitative correctness of Silchter's hypothesis of the cooling of the earth.

ZHARKOV, V. N., "The Physics of the Earth's Core, I: Thermodynamic Properties," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 10, pp. 945-950.

VESIAC No. 1513 Thermodynamic parameters for models of a silicate-and-iron core are determined. The contribution on the part of conduction-electrons to thermodynamic parameters has not been taken into account, since this problem was discussed in earlier articles.

ZHARKOV, V. N., "Physics of the Earth's Core II: Mechanical Properties and Viscosity," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 11, pp. 1039-1044.

VESIAC No. 1522 The author analyzes further the hypothesis of Gutenberg, according to which the wave dispersion in Bullen's F-layer is caused by a viscosity gradient in that layer. Two very simple models of the earth's core are investigated.

ZIPOY, D. See Forward, R. L.

ZUKERNIK, V. B. See Karus, E. V.

ZVEREV, S. M., "Dynamic Peculiarities of Multiple Reflected 'Water' Waves in the Ocean and Their Use in the Determination of Elastic Waves in Sediments," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 1, pp. 12-20.

VESIAC No. 1460 This paper presents an analysis of the travel-time and amplitude curves of multiple reflected water waves found on profiles of deep seismic sounding in the Sea of Okhotsk and the Pacific Ocean.

It is shown that the shape of the amplitude graphs is determined by a change in the reflection coefficient in relation to the incidence angle at the ocean floor.

Possibilities are discussed for determining the velocity in sediments by the experimental amplitude graphs of multiple reflected water waves.

ZVEREV, S. M., "Recordings of Water Waves in Regions of the Boundary of the Shadow Zone, Which is Generated by Ocean Bottom," Bull. Acad. Sci. USSR, Geophys. Ser., 1960, No. 8, pp. 776-785.

VESIAC No. 1502 The author investigates properties of waves which are generated from refracted water waves beyond the point of emergence of the ray which grazes the bottom of the ocean. Experimental data on the attenuation is compared with theoretical data calculated for various models. On the basis of the comparison, conclusions are made concerning the nature of the observed waves.

ZVEREV, S. M., "The Use of Sound Records for Distance Determination During Operations of Deep Seismic Sounding at Sea," Bull. Acad. Sci. USSR, Geophys. Ser., 1959, No. 4, pp. 385-392.

VESIAC No. 1355 The author, basing his suggestions on the analysis of the kinematic picture of the arrival of sound and on the comparison of this picture with the observed sound recordings, proffers methods for determining distance from the shot point to the recording station with an error not over 1%.

ZVOLINSKII, also spelled Zvolinsky, Zvolinski.

ZVOLINSKII, N. V., "Reflected and Head Waves Emerging at a Plane Interface of Two Elastic Media – I," Bull. Acad. Sci. USSR, Geophys. Ser., 1957, No. 10, pp. 1-21.

VESIAC No. 1705 Reflected and head waves arising at a plane interface of two elastic media are investigated by the method of functional invariant solutions. A method of separating an asymptotic part of the wave field is also given.

ZVOLINSKY, N. V., "Reflected Waves and Head Waves Arising at a Plane Interface Between Two Elastic Media – II," Bull. Acad. Sci. USSR, Geophys. Ser., 1958, No. 1, pp. 1-8.

VESIAC No. 1247 The reflected wave PS and the head waves PPP, PPS are investigated as they originate on a plane boundary of separation between elastic media. The exact solutions are developed into asymptotic formulas which are accurate in an area near the wavefront.

ZVOLINSKI, N. V. See Zaiev, L. P.

Appendix
REPORTS AND ARTICLES SPONSORED BY THE VELA UNIFORM PROGRAM

BENIOFF, H., and F. PRESS, Seismic Surface Wave Studies and Seismograph Development, Semi-Ann. Rept. No. 2, Contract AF 49(638)-910, Calif. Inst. Tech., Pasadena, Calif., 1962.

CARRON, J. P., P. NOZIERER, and F. PERRIN, "Seismo-geology: Variations of Background Seismic Noise in the Parisian Basin," in Comptes rendus des seances de L'Academie des Sciences, t. 248, Gauthier-Villars, Paris, France, pp. 3462-3464, 1959.

CHABAI, A. J., et al., Close-in Phenomena of Buried Explosions, Rept. No. SC-4711(RR) on Contract DASA-EO-300-60, Sandia Corp., Albuquerque, New Mex., 1961.

DORMAN, J., "Period Equation for Waves of Rayleigh Type on a Layered, Liquid-Solid Half Space," Contr. No. AF 19(604)-8375, Bull. Seis. Soc. Am., 1962, Vol. 52, No. 2, pp. 389-397.

FORBES, C. B., R. A. PETERSON, and V. R. MC LAMORE, VELA UNIFORM, Operation DRIBBLE, On-Site Cavity Location, Seismic Profiling, Tatum Salt Dome, Lamar County, Miss., Contract AF 33 (600) 42384 , United ElectroDynamics, Inc., Pasadena, Calif., 1961.

FRANTTI, G. E., Auditory Recognition of Seismic Disturbances, Rept No. 4595-2-P, Contract AF 49(638)-1079, Inst. Sci. Tech., The Univ. of Mich., Ann Arbor, Mich., 1962.

HOOK, J. F., M. H. LOCK, and T. KARLSSON, A Theoretical Study on Propagation of Seismic Waves in an Inhomogeneous Earth, Semi-Ann. Tech. Sum. Rept., Contract AF 49(638)-1082, Nat'l Engr. Sci. Co., Pasadena, Calif., 1961.

JACKSON, W. J., S. W. STEWART, and L. C. PAKISER, Crustal Structure in Western United States, Part II: Crustal Structure in Eastern Colorado From Seismic-Refraction Measurements, ARPA Order No. 193-61, U. S. Geological Survey, Denver, Colo., 1962 (OFFICIAL USE ONLY).

KELLER, G. V., A Program of Research on the Electrical Properties of the Earth's Crust, with Emphasis on the Detection of Underground Nuclear Explosions, ARPA Order No. 193-61, U. S. Geol. Survey, Denver, Colo., 1961.

KISSLINGER, C., Seismic Waves Generated by Chemical Explosions, Semi-Ann. Tech. Rept. No. 2, Contract AF 19(604)-7402, St. Louis Univ., St. Louis, Mo., 1962.

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MATHEY, R., Y. ROCARD, and F. PERRIN, "Performances of Some Seismographs with Short Periods," Comptes rendus des seances de L'Academie des Sciences, t. 248, pp. 1-3.

PAKISER, L. C., Crustal Structure in Western United States, Part I: Summary of Crustal Studies by the U. S. Geological Survey, ARPA Order No. 193-61, U. S. Geol. Survey, Denver, Colo., 1962 (OFFICIAL USE ONLY).

PEKERIS, C. L., Z. ALTERMAN, and H. JAROSCH, Effect of the Rigidity of the Inner Core on the Fundamental Oscillation of the Earth, Tech. Note No. 3, Contract AF 61(052)-509, Weizman Inst. of Science, Rehovot, Israel, 1962.

PEKERIS, C. L., Z. ALTERMAN, and H. JAROSCH, "Rotational Multiplets in the Spectrum of the Earth," Physical Review, 1961, Vol. 122, No. 6, pp. 1692-1700.

PRESS, F., and D. HARKRIDER, Propagation of Acoustic-Gravity Waves in the Atmosphere, Contribution No. 1086, Contract AF 49(638)-910, California Inst. Tech., Pasadena, Calif., no date.

SIMPSON, S. M., Jr., Time Series Techniques Applied to Underground Detection and Further Digitized Seismic Data, Rept. No. AFCRL 62-262, Contract AF 19(604)-7378, Mass. Inst. Tech., Cambridge, Mass., 1961.

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